

Fig. 1.

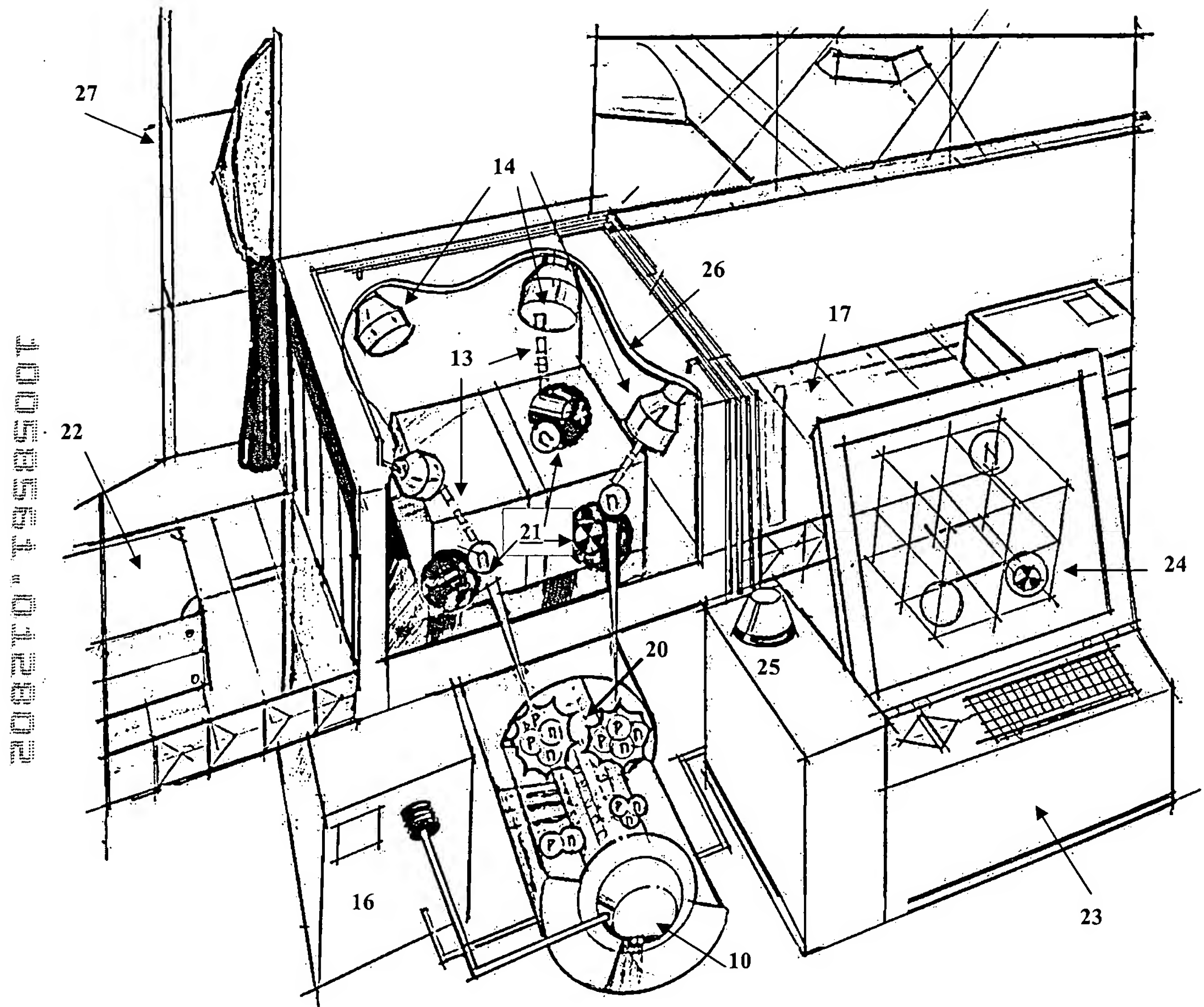
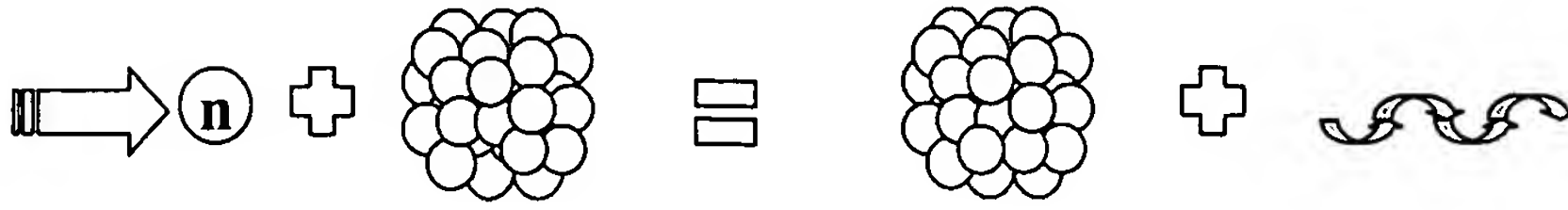


Fig. 2.

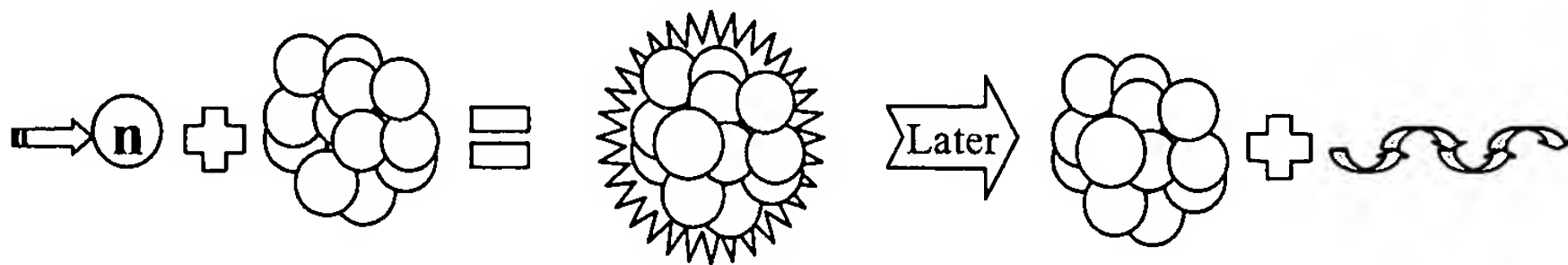
(a) Prompt Gamma Neutron Activation Analysis



Neutron + nucleus = nucleus with extra neutron + characteristic gamma ray

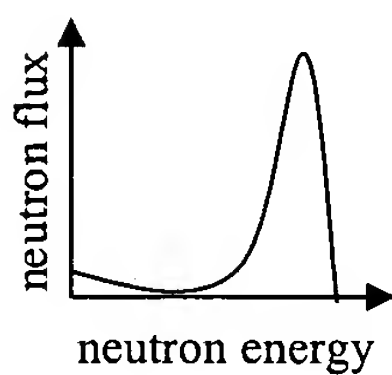
The photon (gamma) that is emitted has a characteristic wavelength (color) that identifies the element.

(b) Delayed Gamma Neutron Activation Analysis

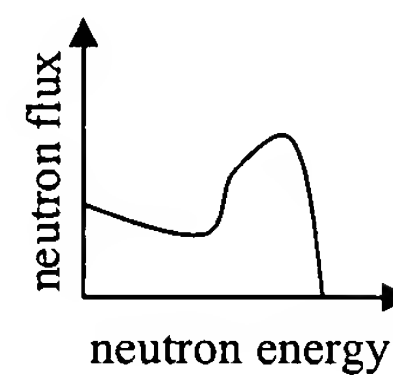


Neutron + nucleus = activated nucleus with extra neutron
which emits a characteristic gamma ray when it decays

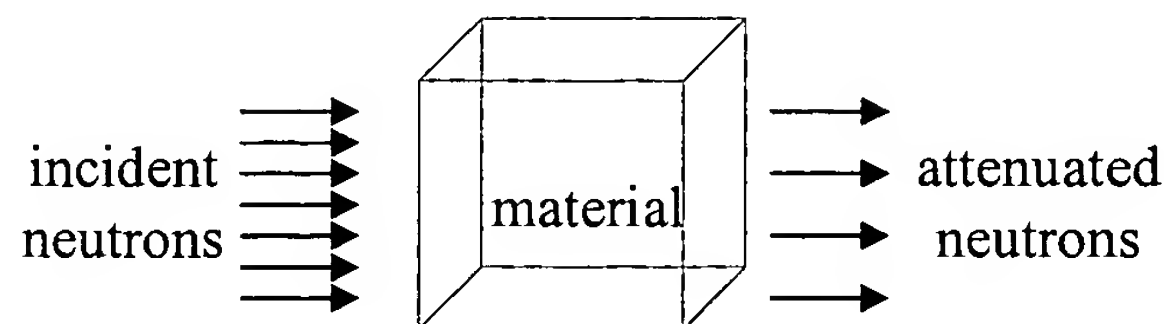
Bulk Material Property Analysis with Neutrons



(c) Neutron Energy before Entering Material
(slight energy scattering due to neutrons
passing through neutron generator)

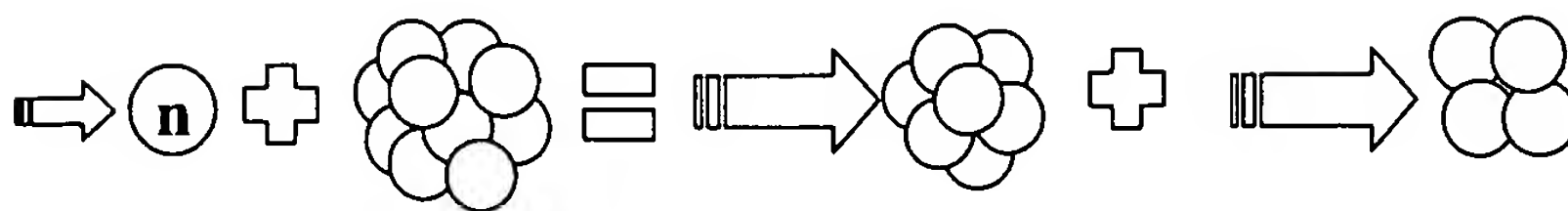


(d) Neutron Energy after Passing through Material
(marked energy scattering due to material
properties)



(e) By comparing neutron fluxes before and after passing through the material, various material properties can be calculated, including density, thickness, porosity, and moisture content.

Fig. 3.



Thermal Neutron + Boron-10 = Energetic Lithium-7 + Energetic Alpha

Fig. 4a.

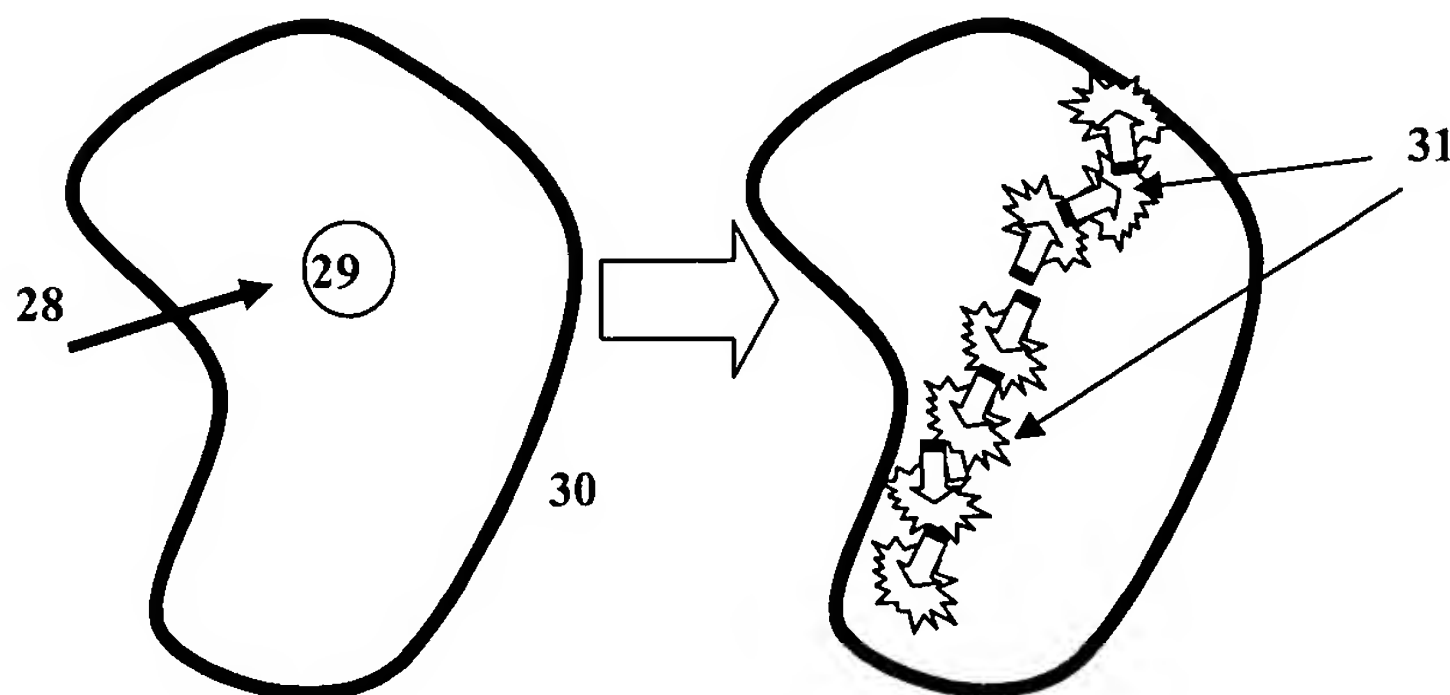


Fig. 4b.

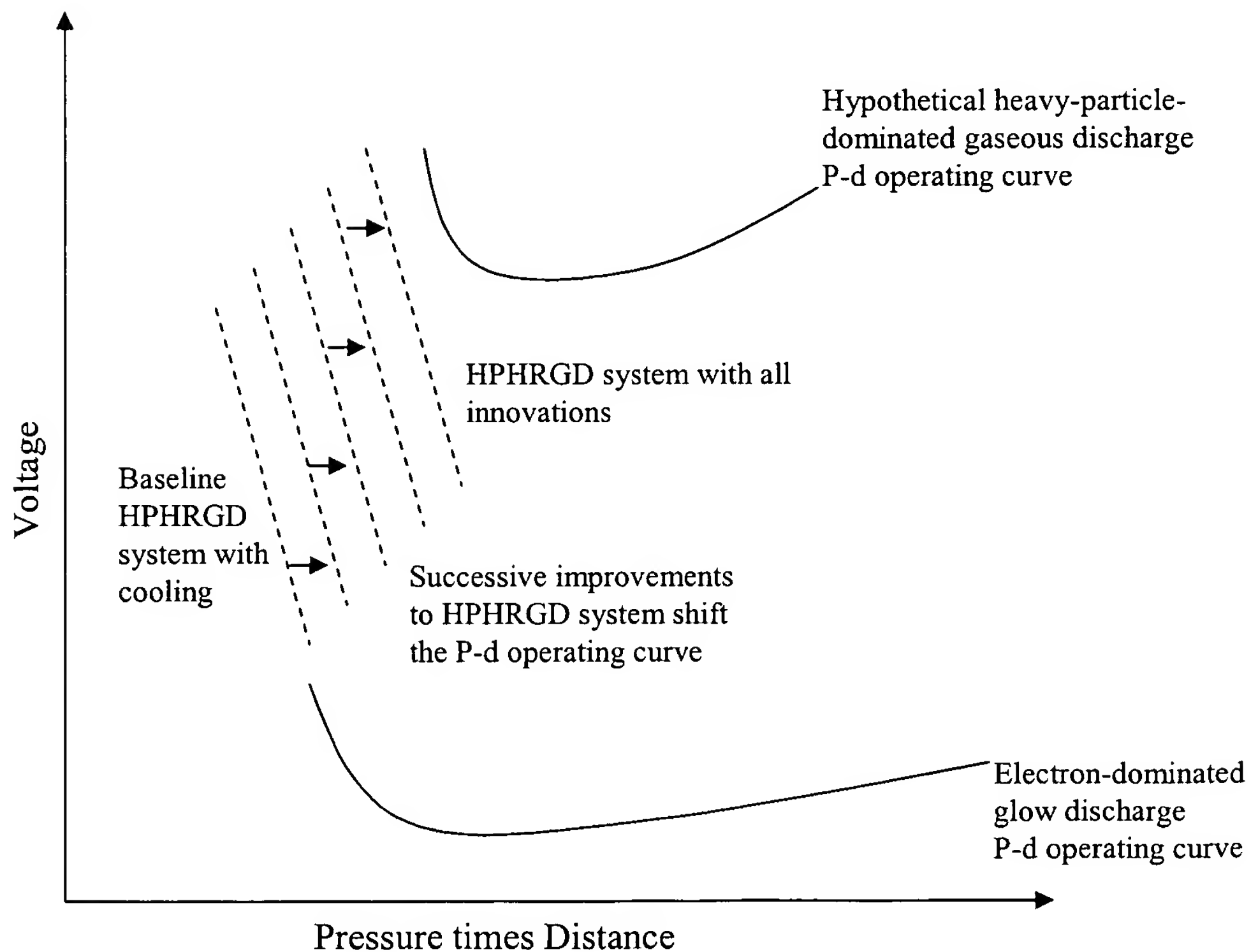


Fig. 5.

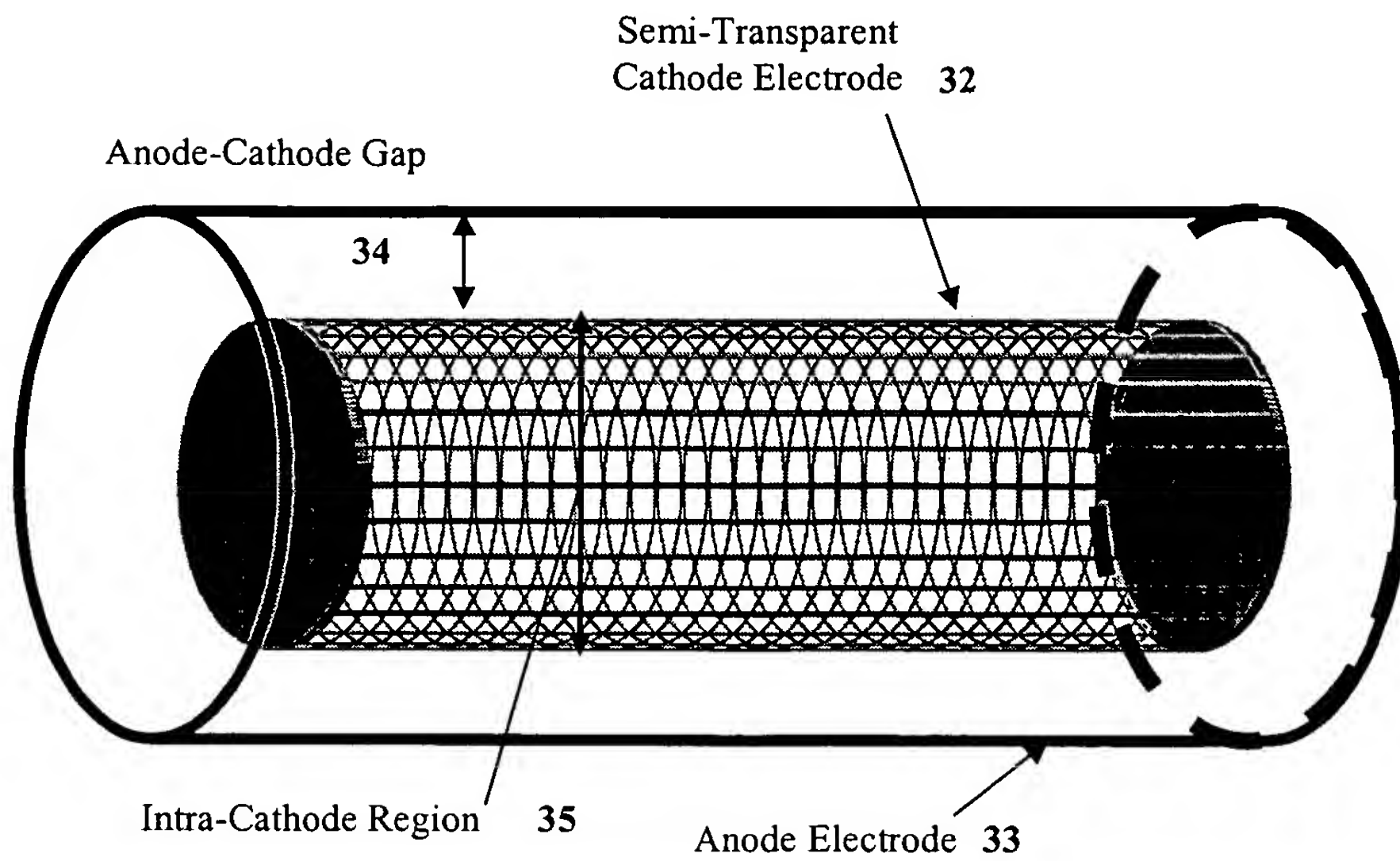


Fig. 6.

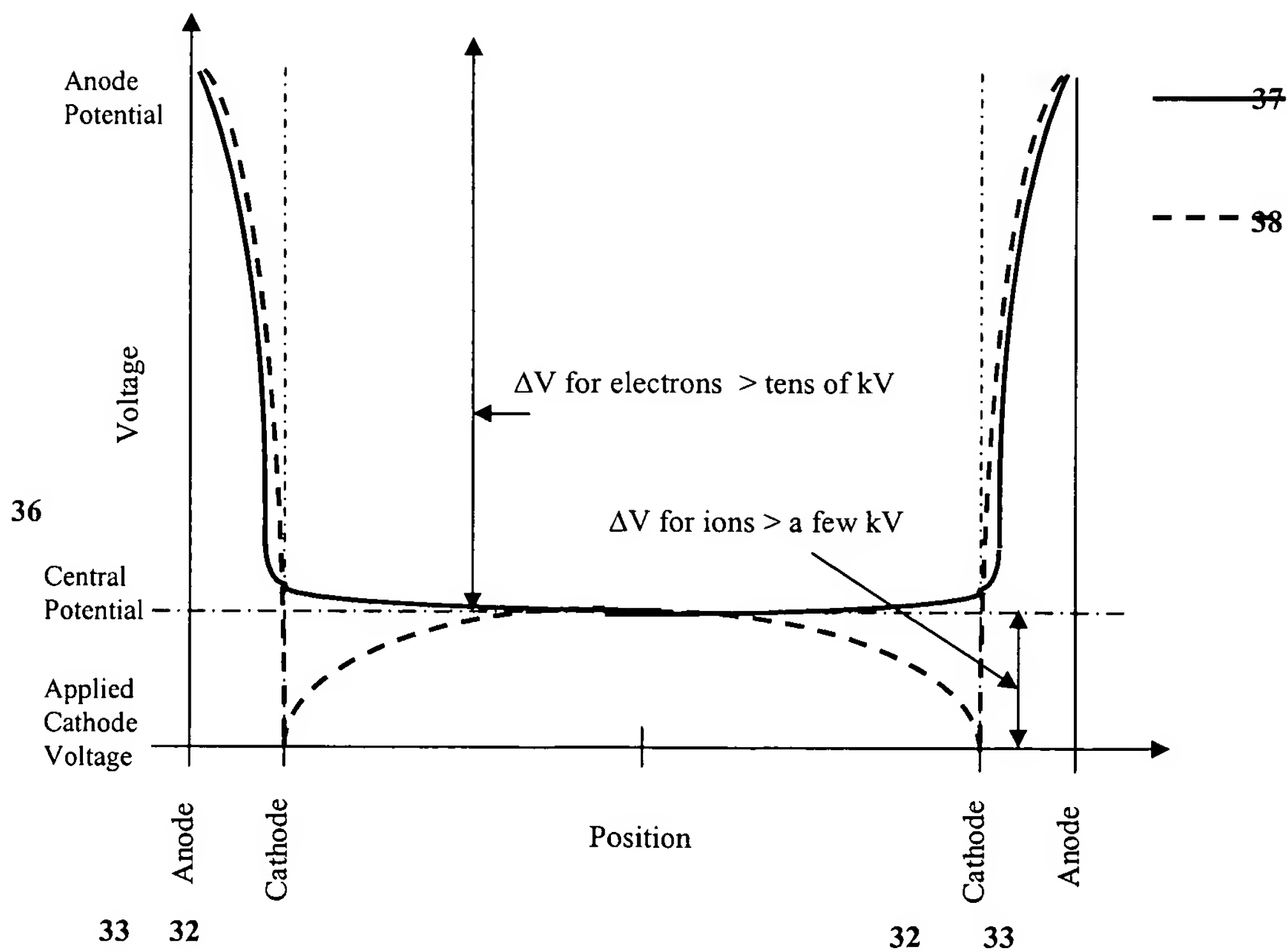


Fig. 8.

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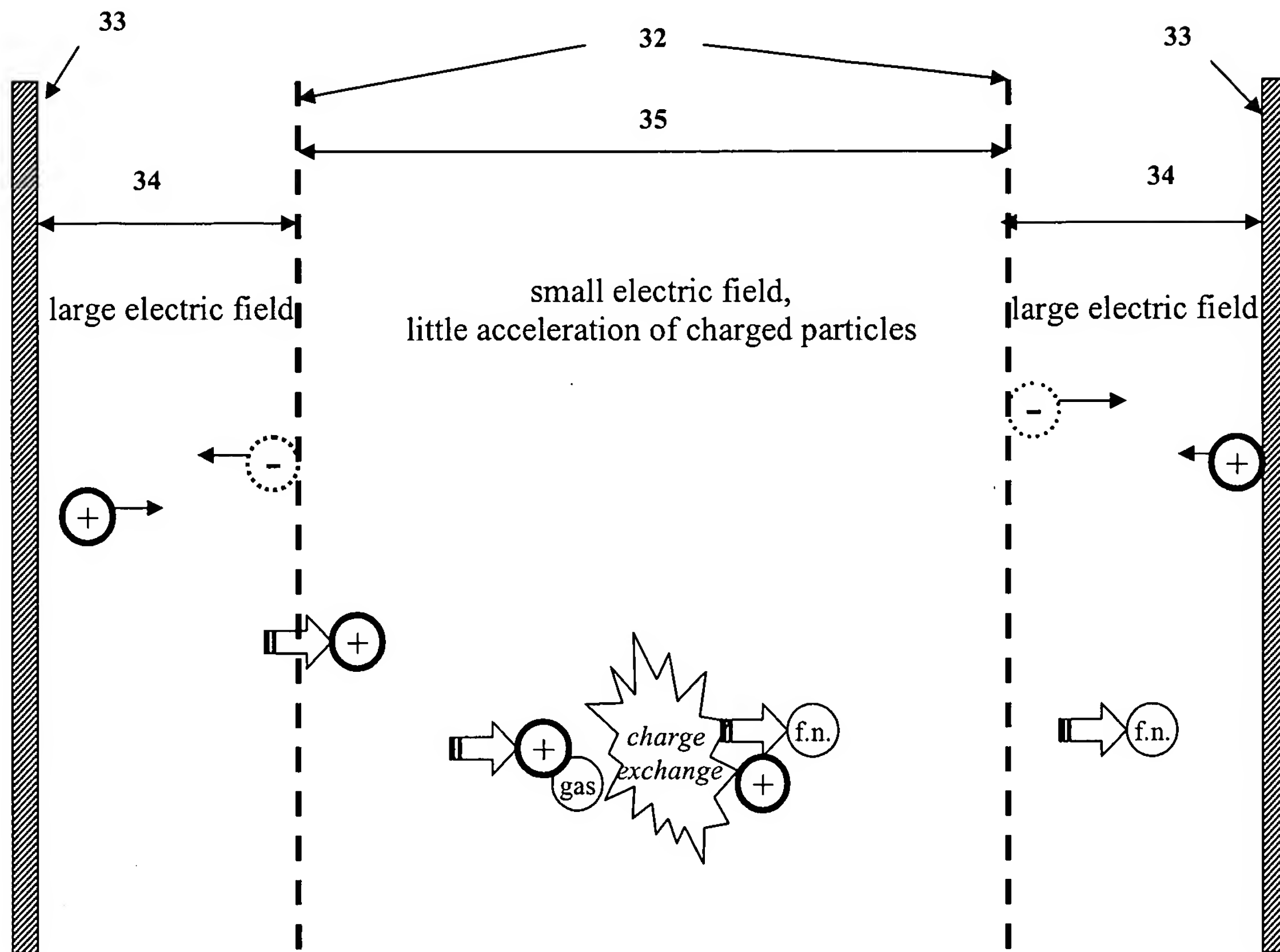


Fig. 7.

Key for Symbols Used in Figures 7, 9, and 33

electron	gaseous discharge particle has energy for collision (above thermal equilibrium)
positive ion (such as deuterium)	collision
fast neutral (such as deuterium)	neutron
background gas (such as deuterium)	helium-3

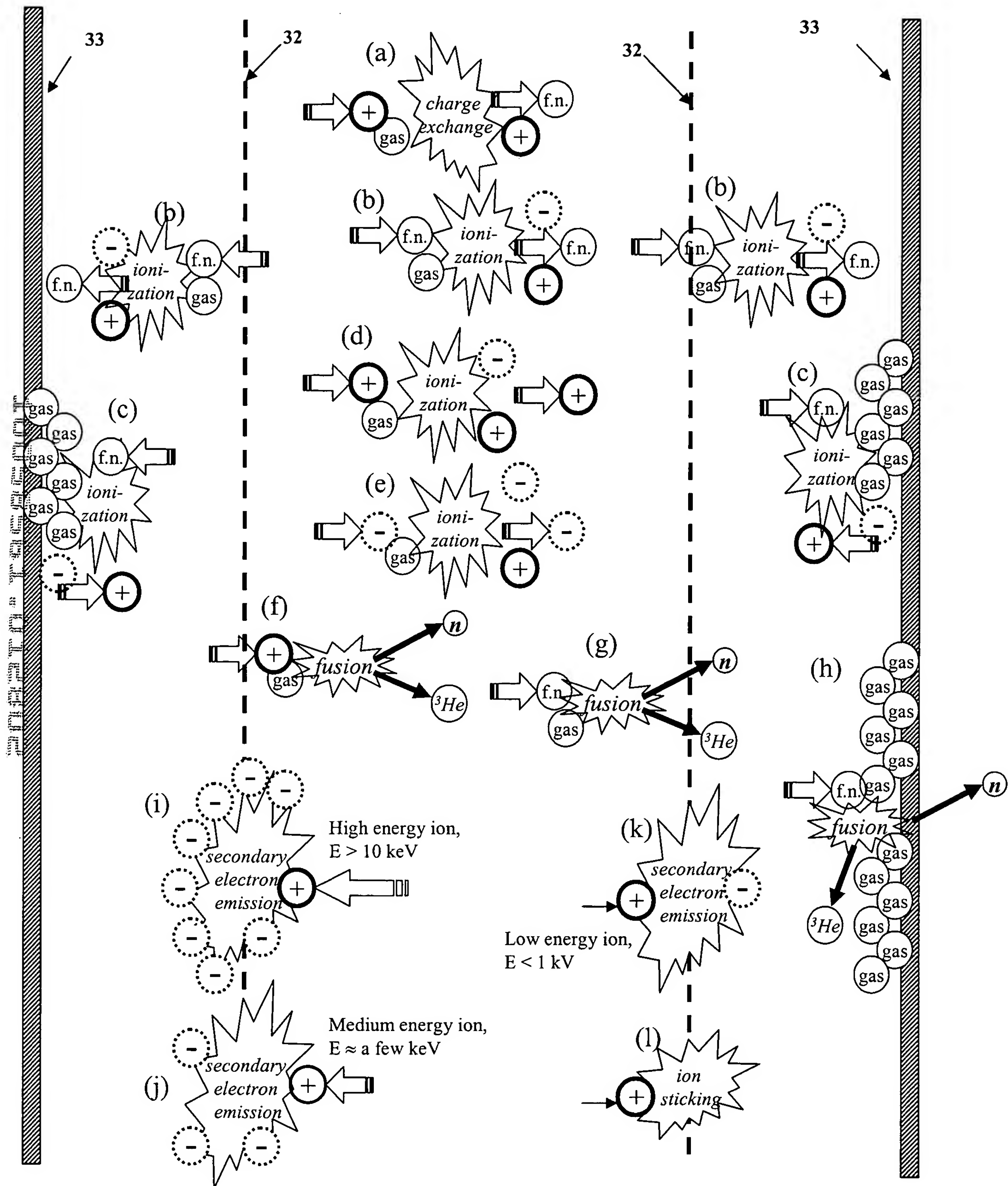


Fig. 9.

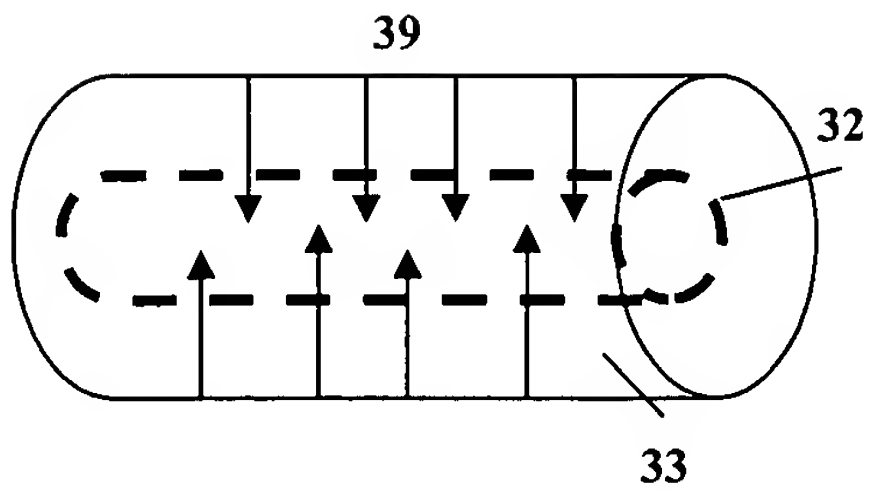


Fig. 10a.

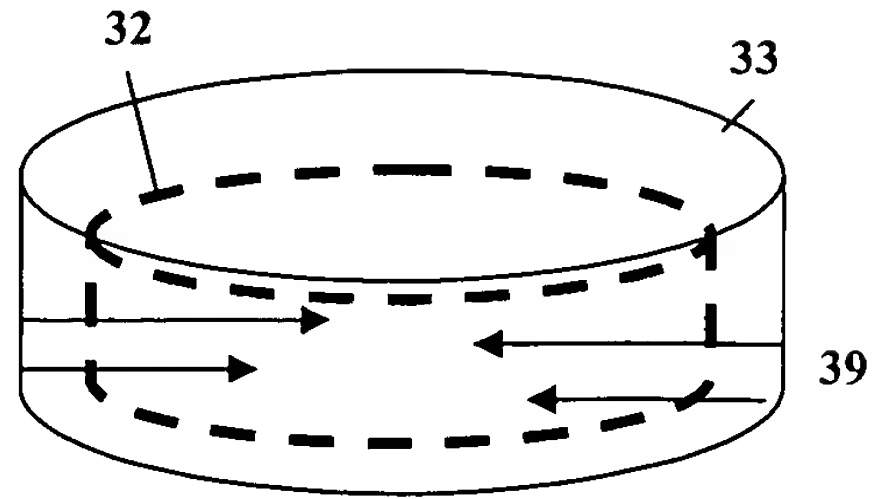


Fig. 10b.

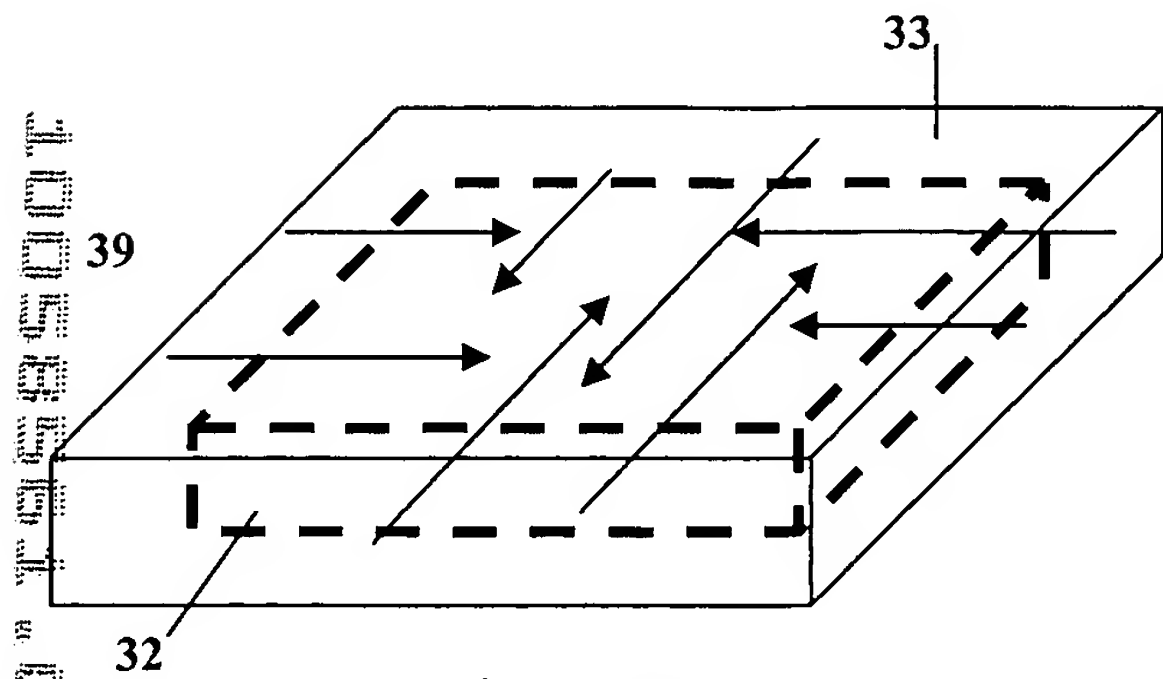


Fig. 10c.

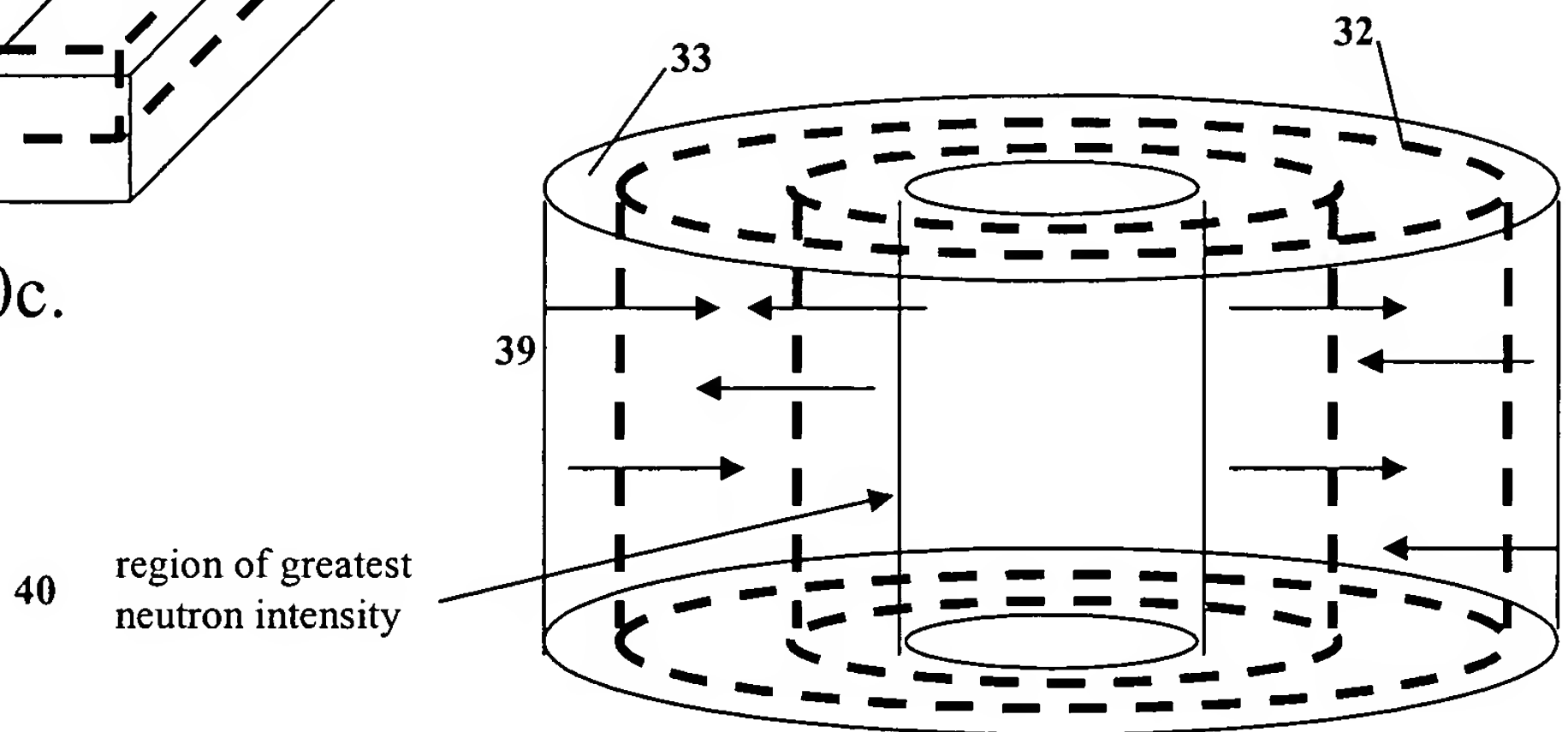


Fig. 10d.

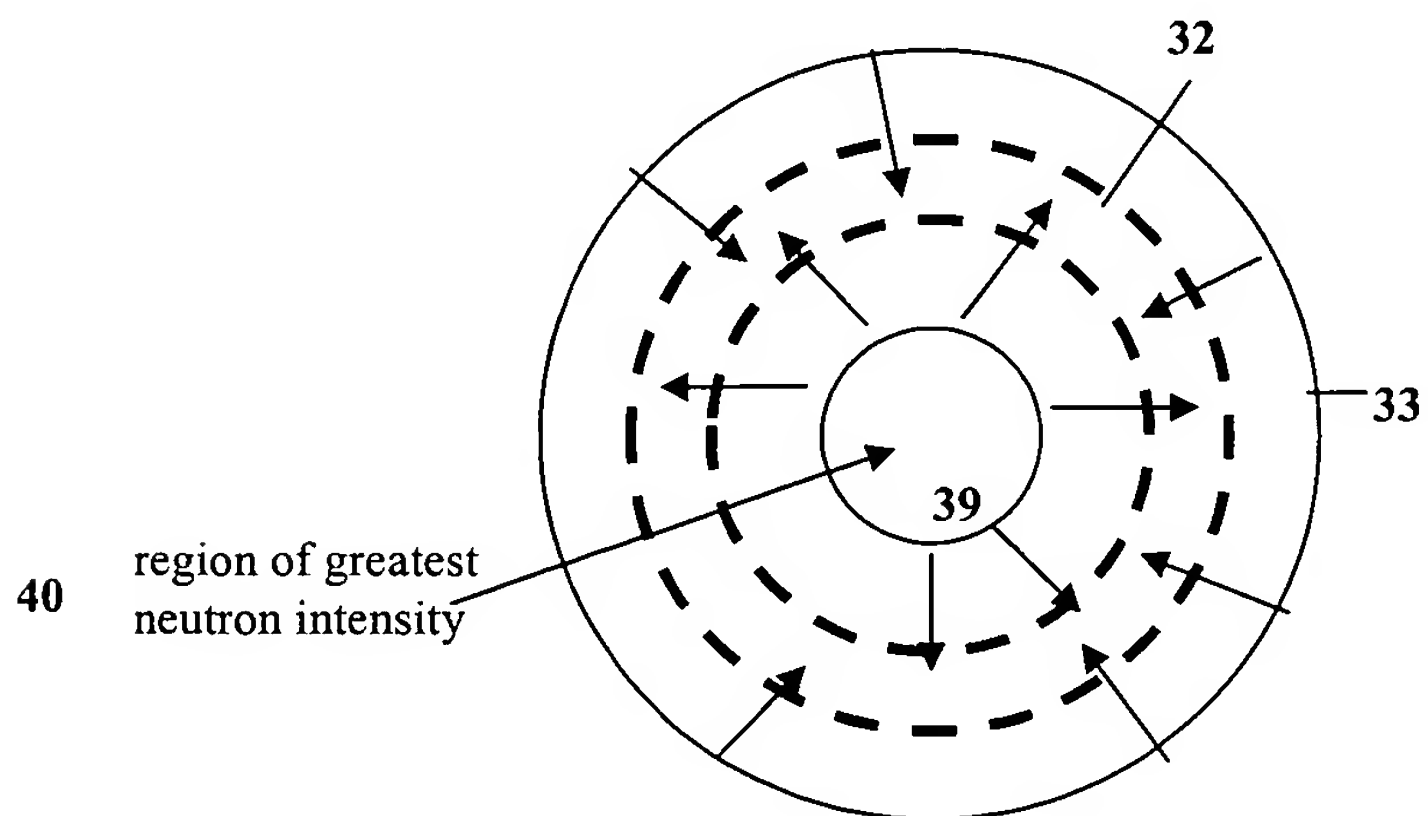


Fig. 10e.

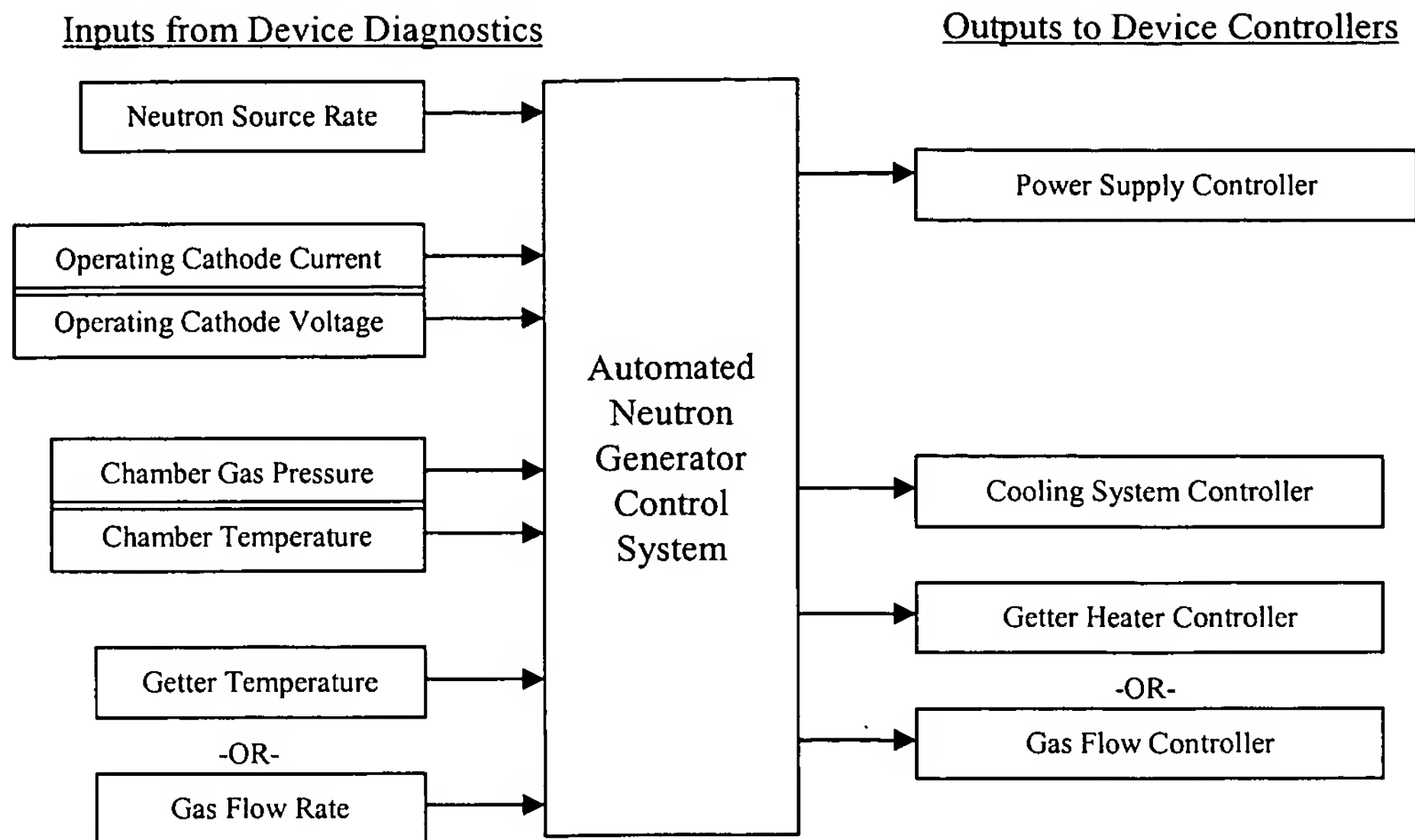


Fig. 11.

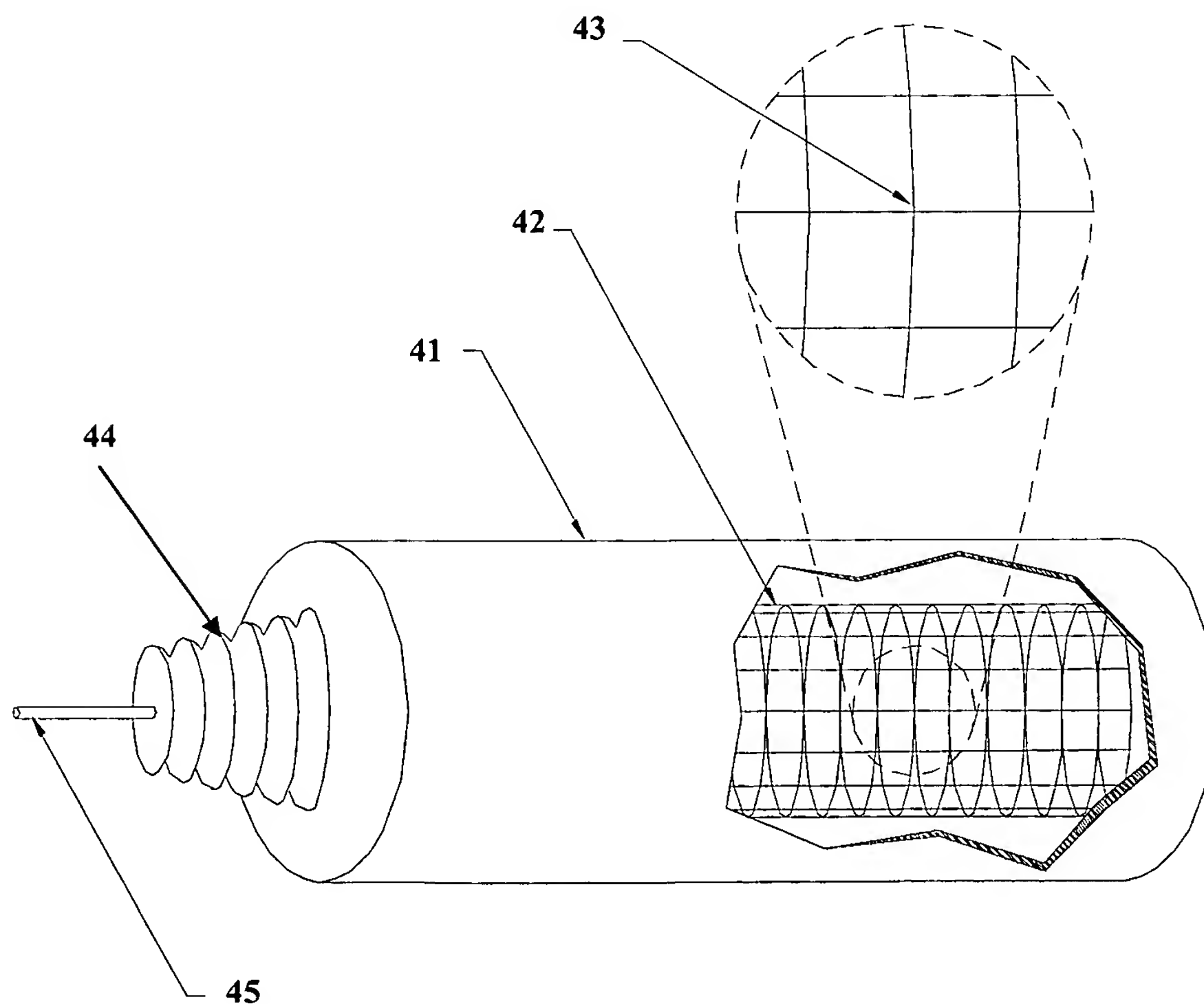
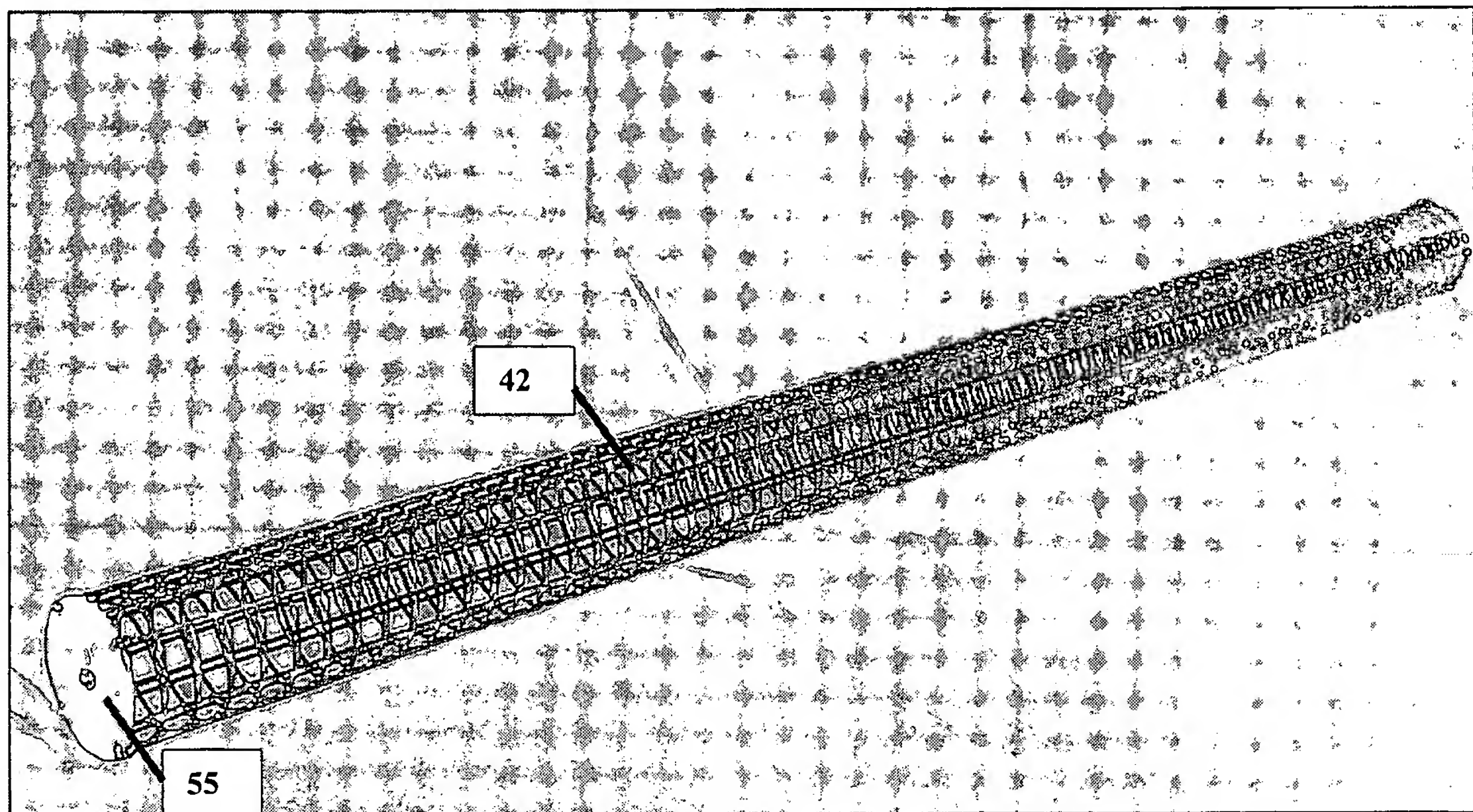
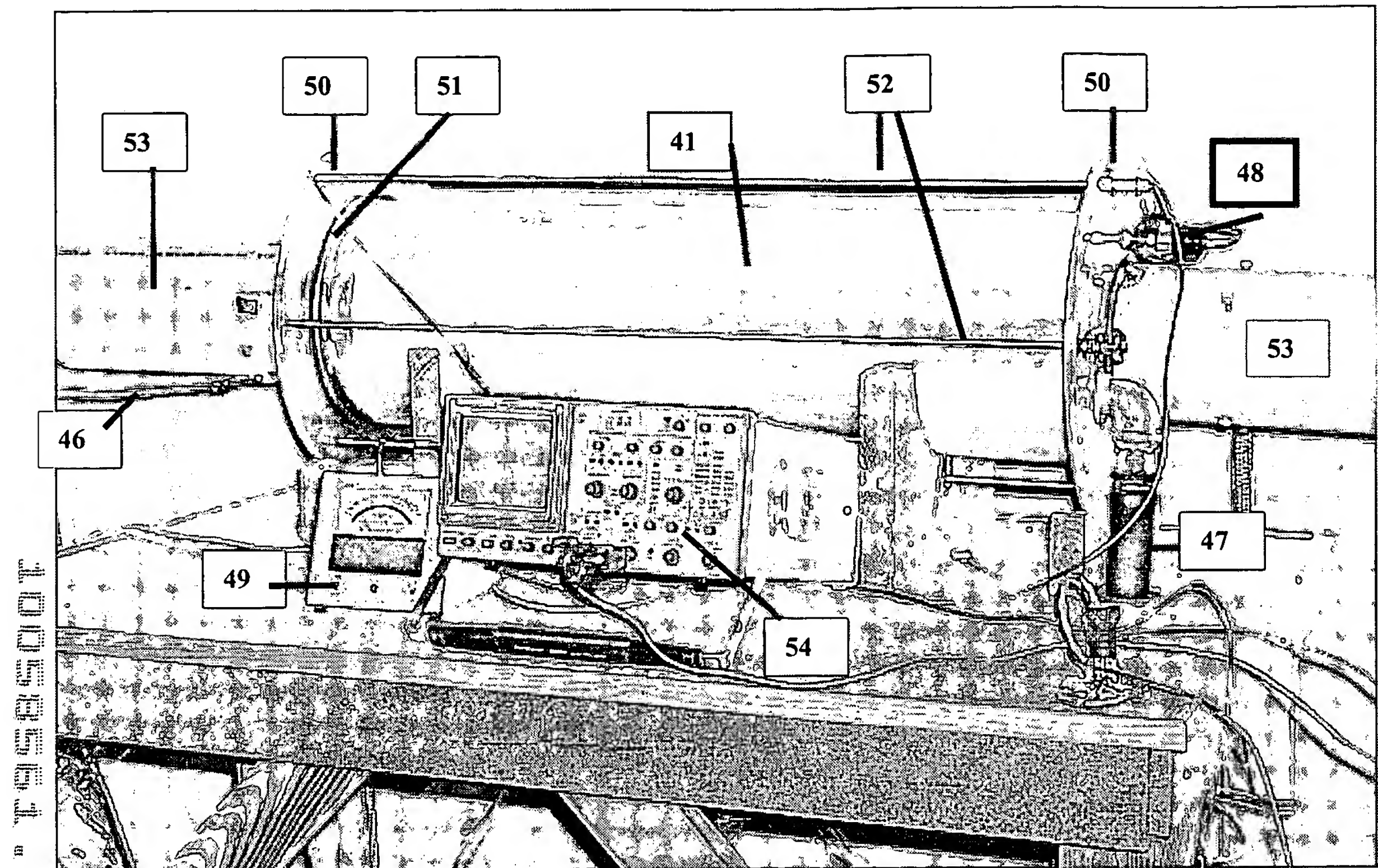


Fig. 12.



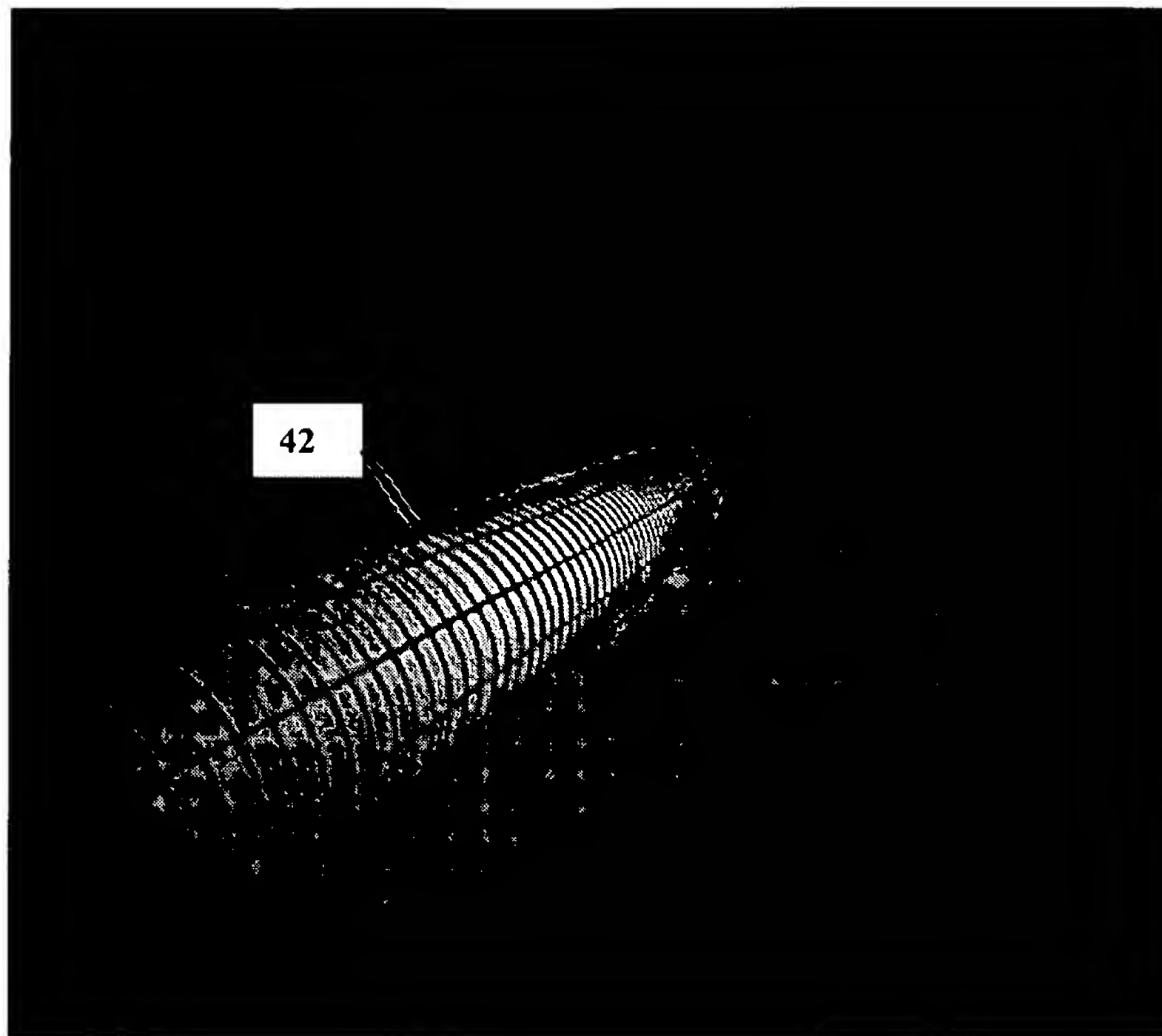


Fig. 15.

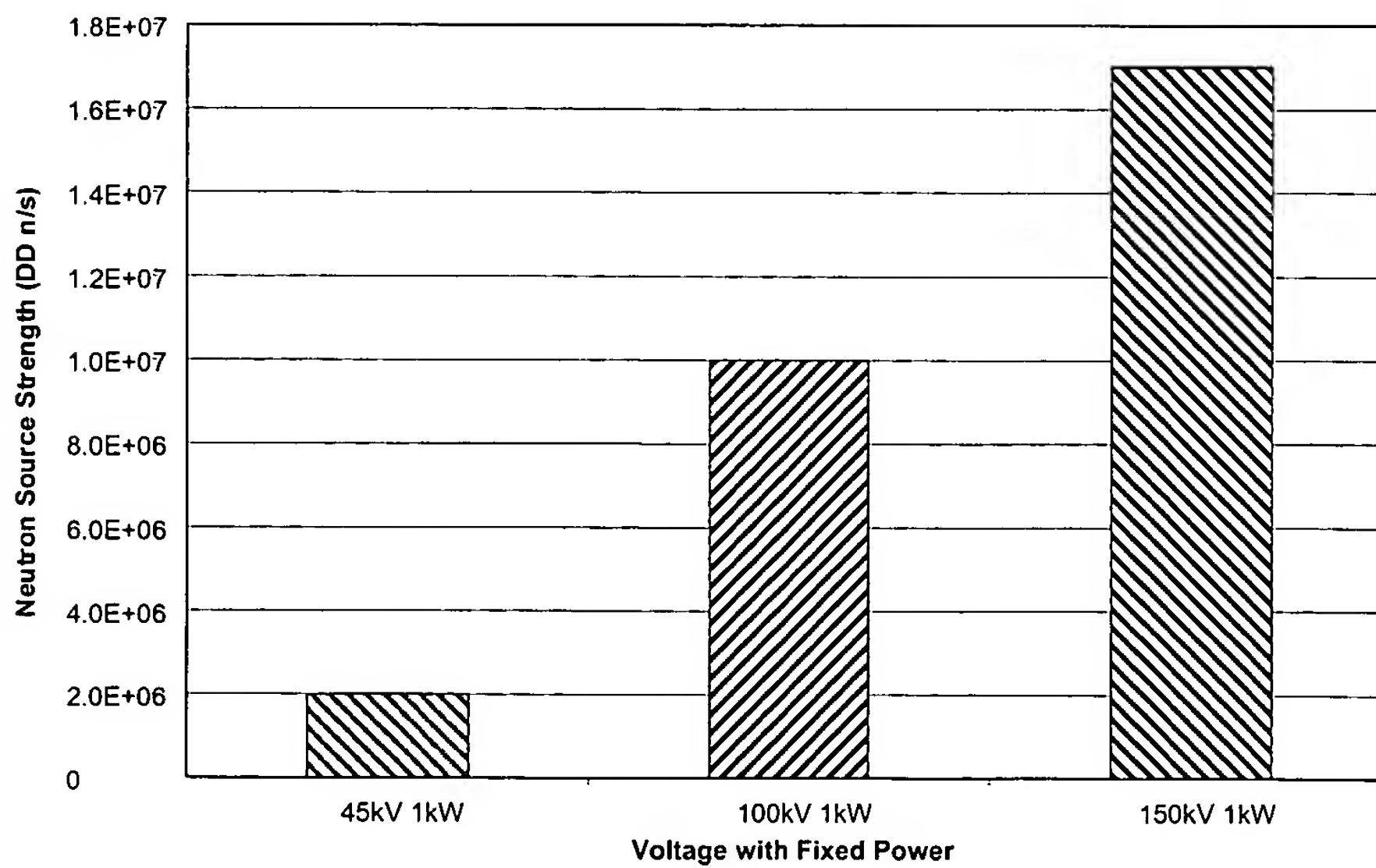


Fig. 16.

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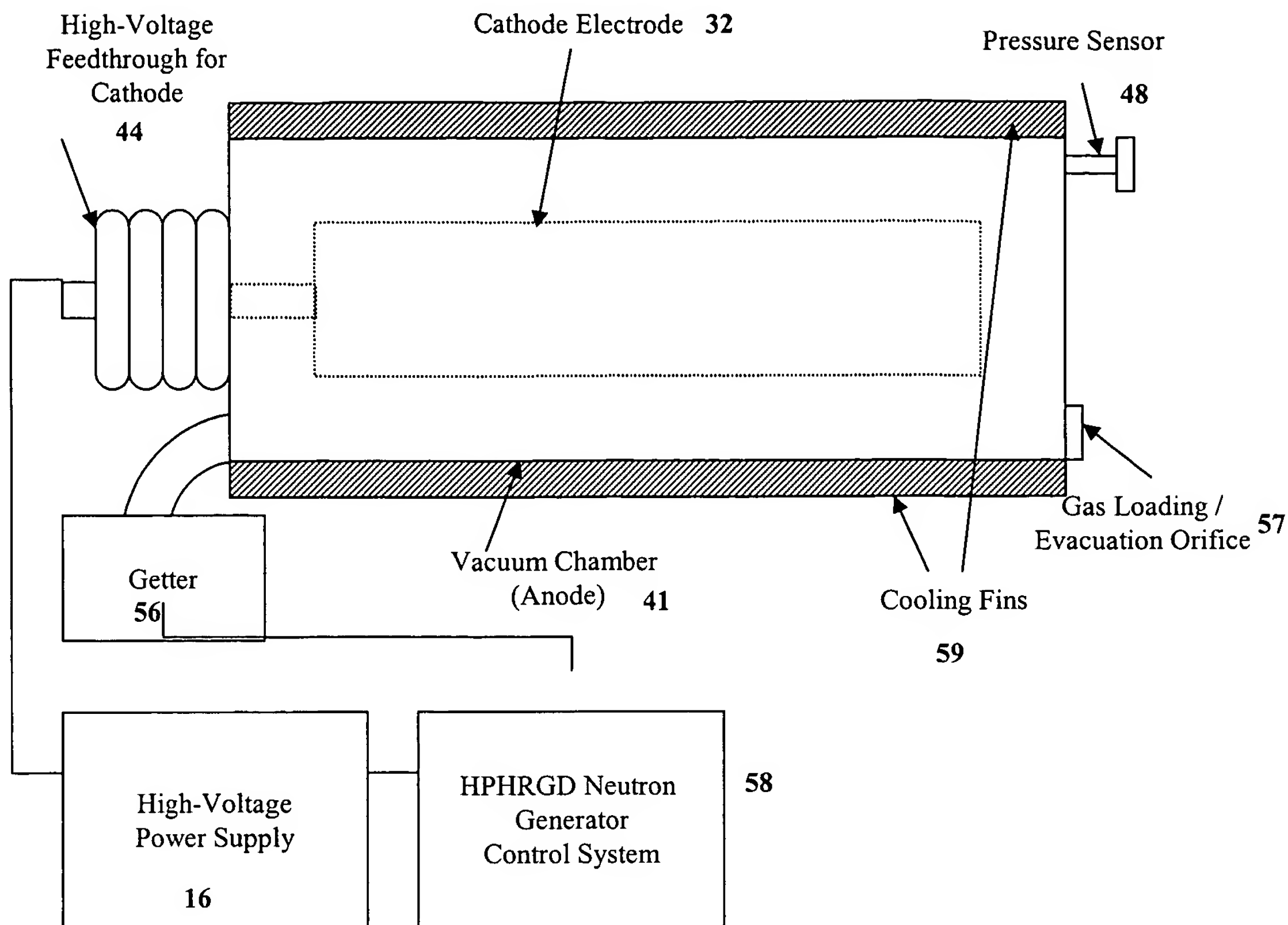


Fig. 17.

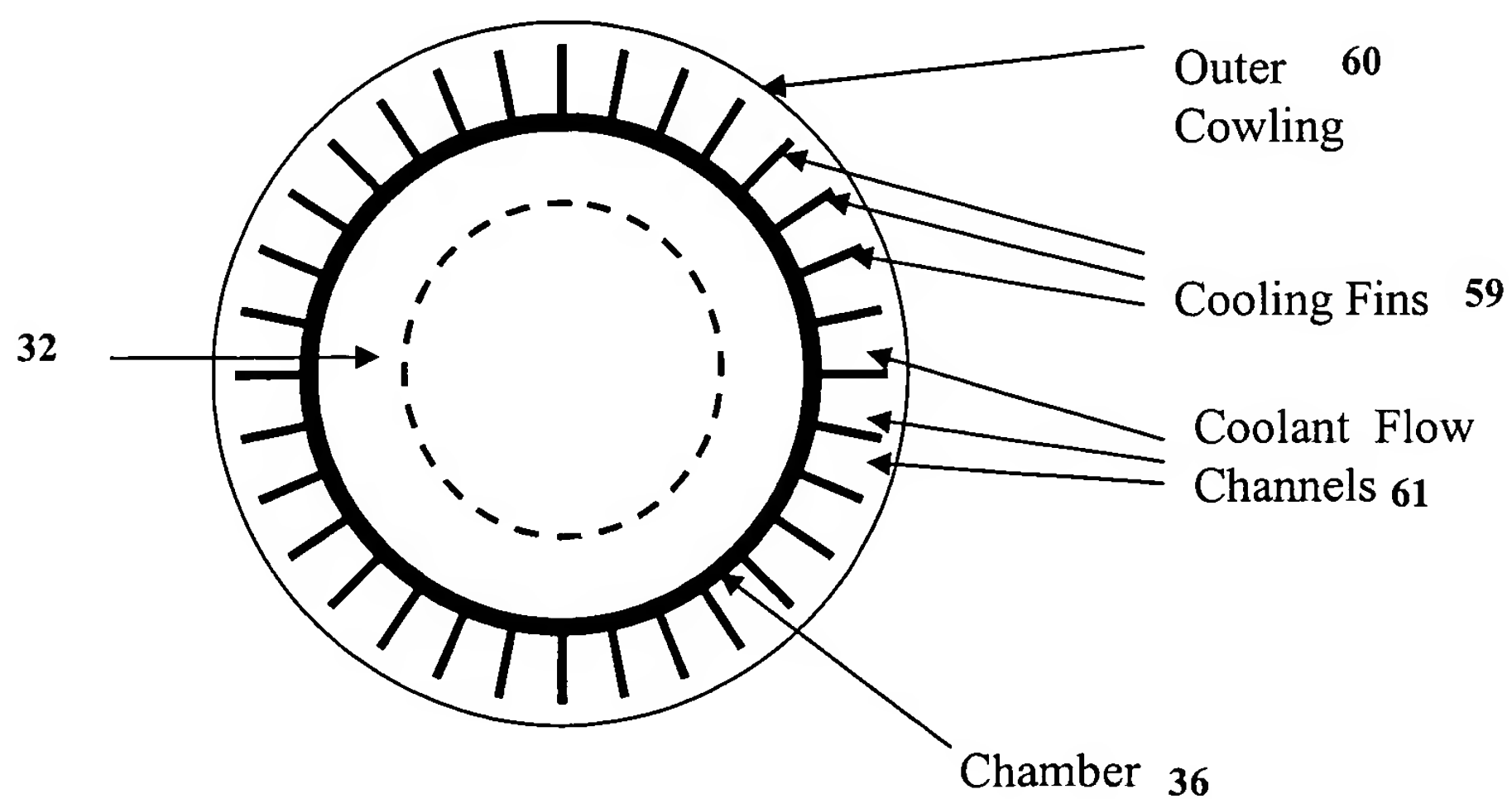


Fig. 18.

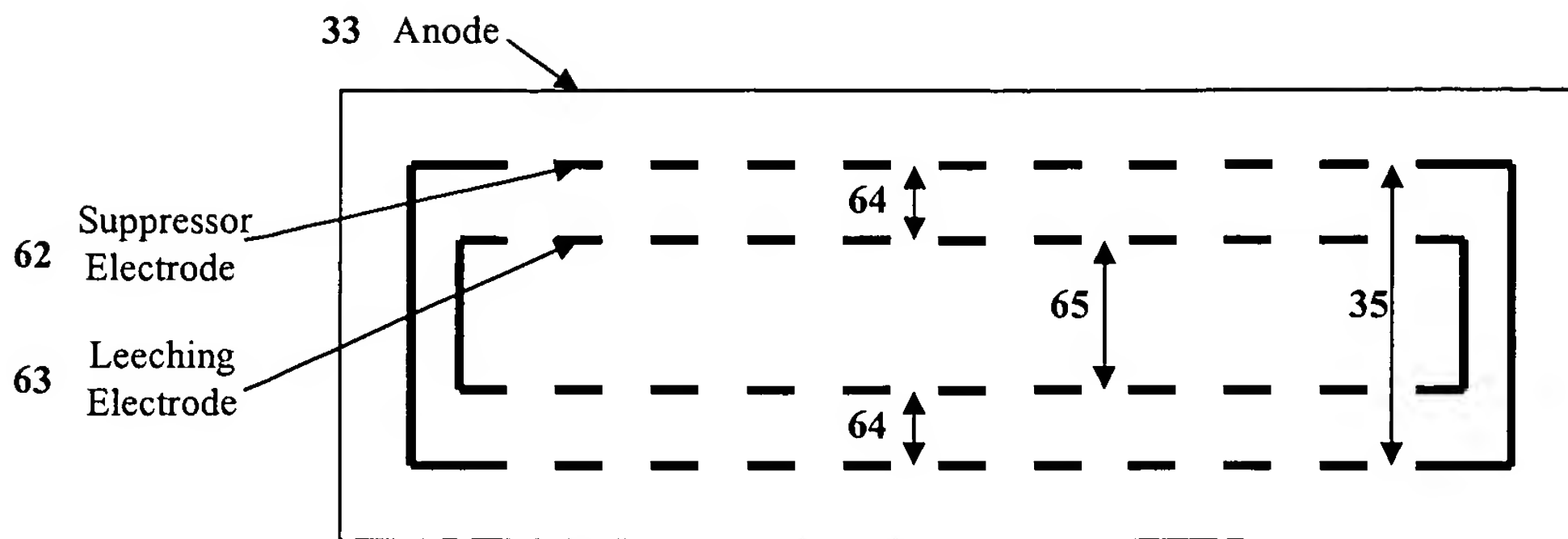


Fig. 19.

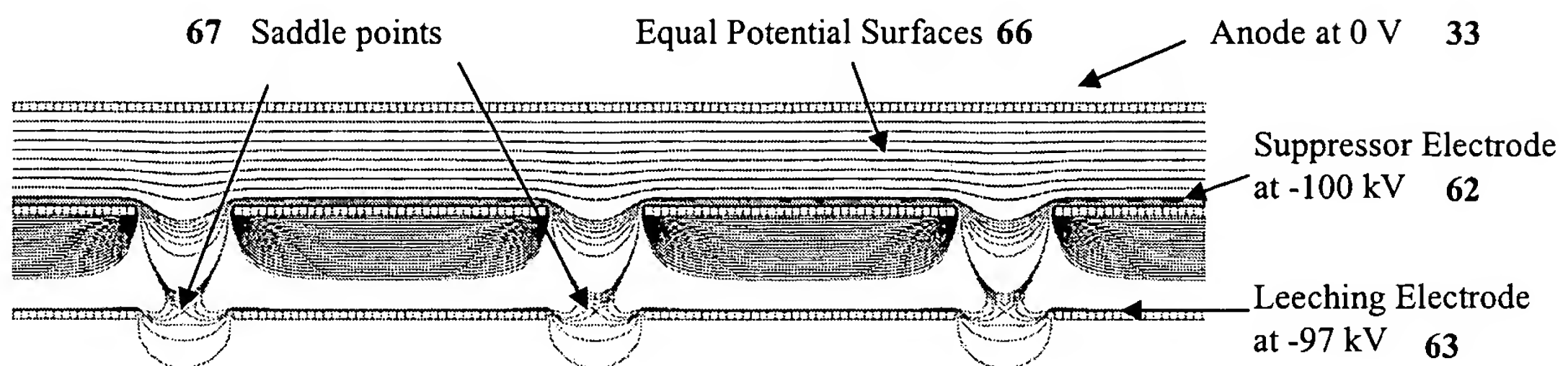


Fig. 20.

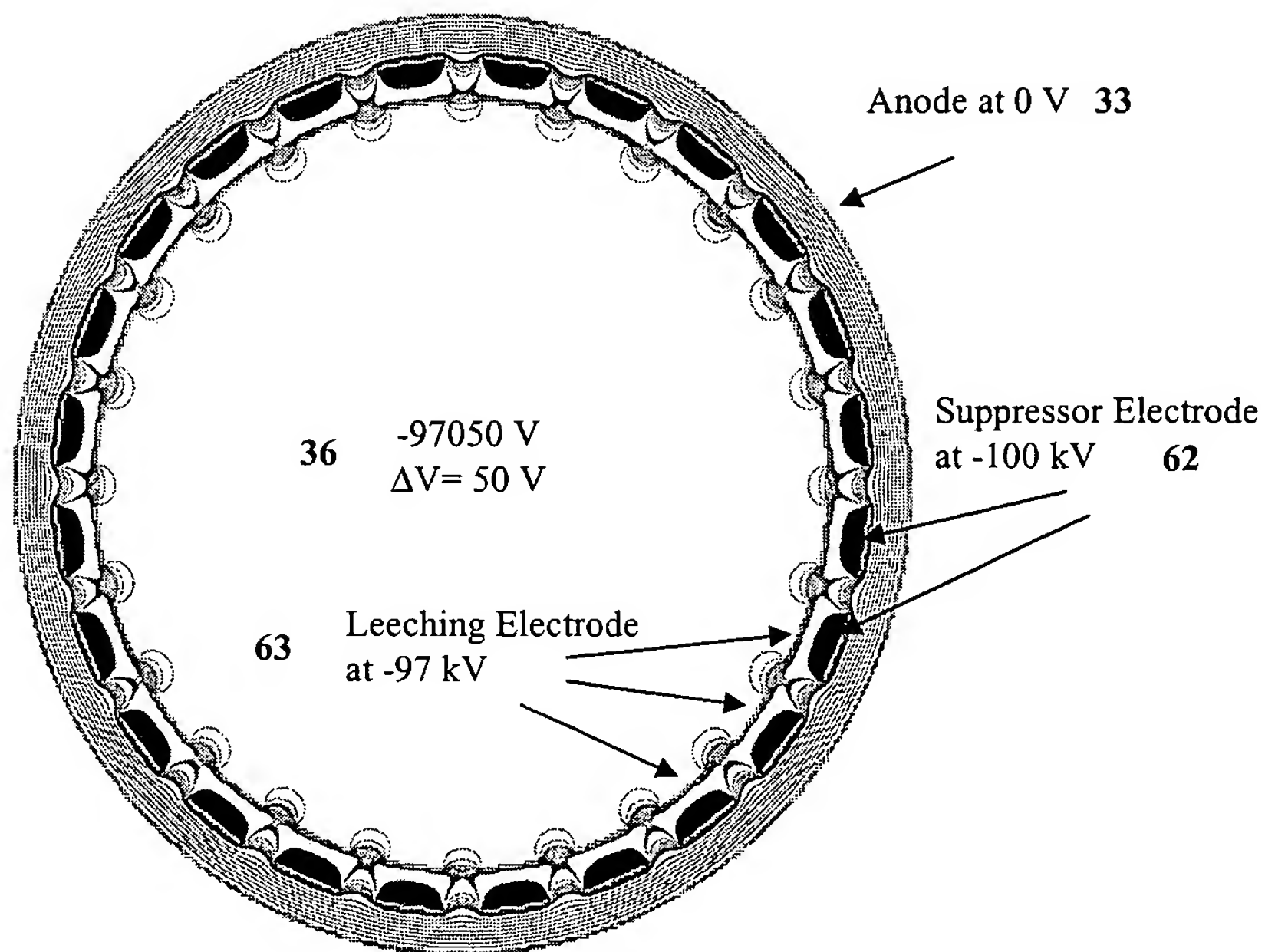


Fig. 21.

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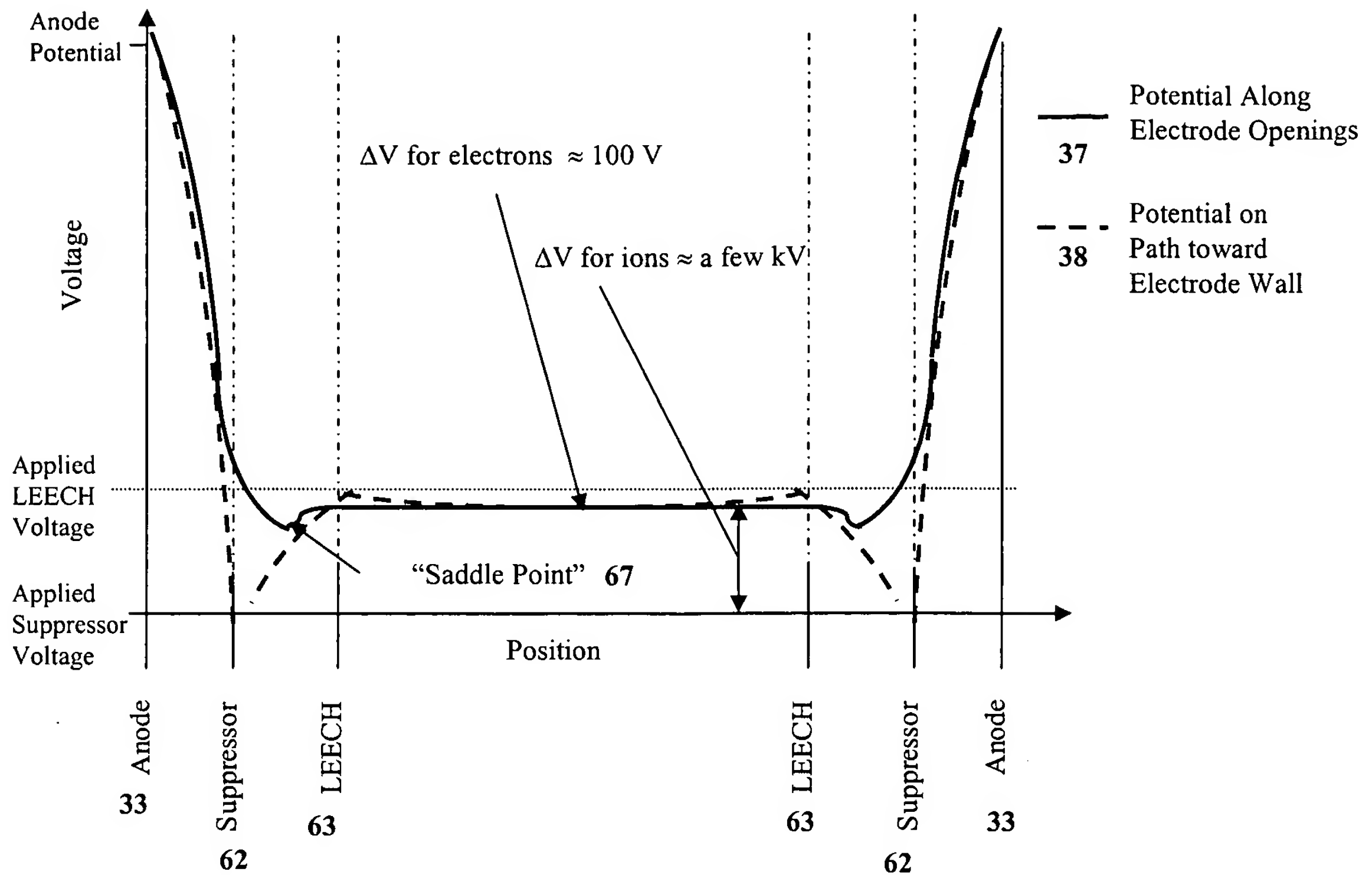


Fig. 22.

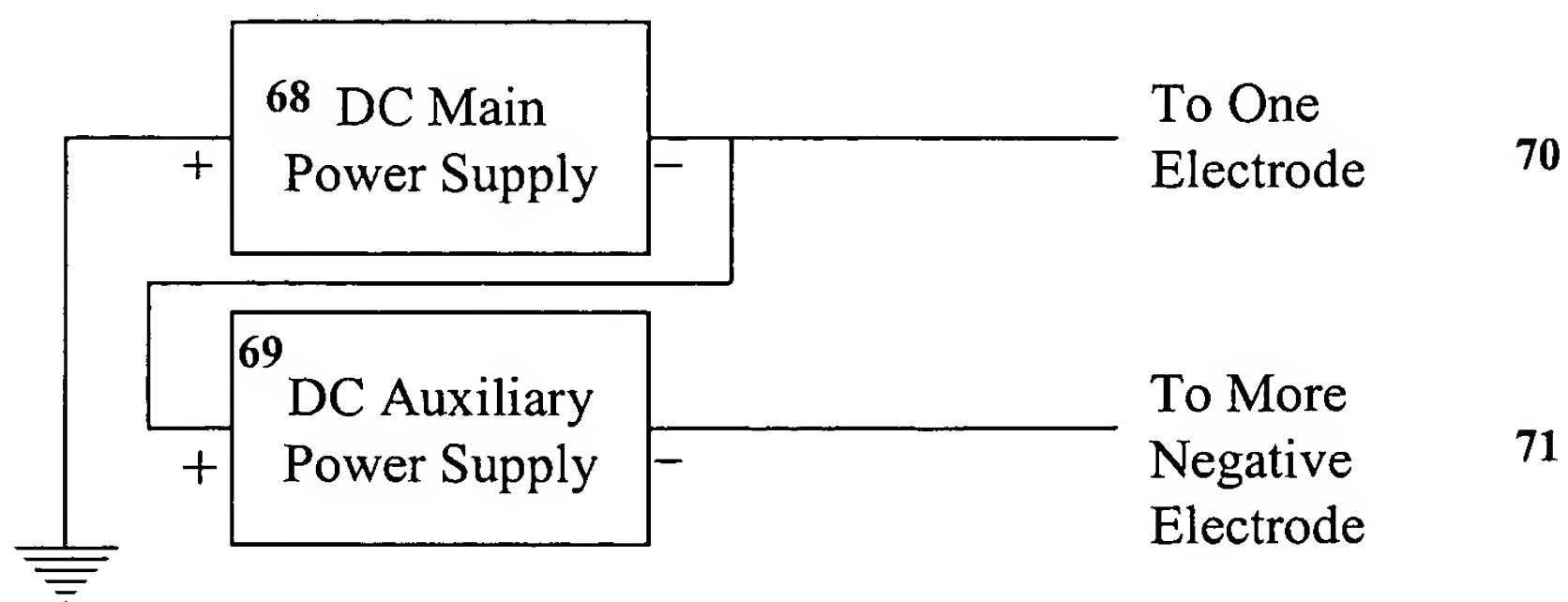
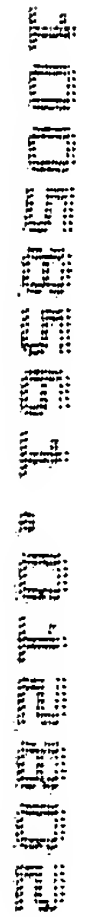
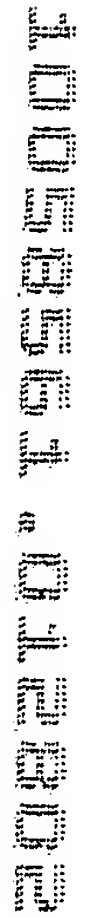


Fig. 23(a).



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709961-01

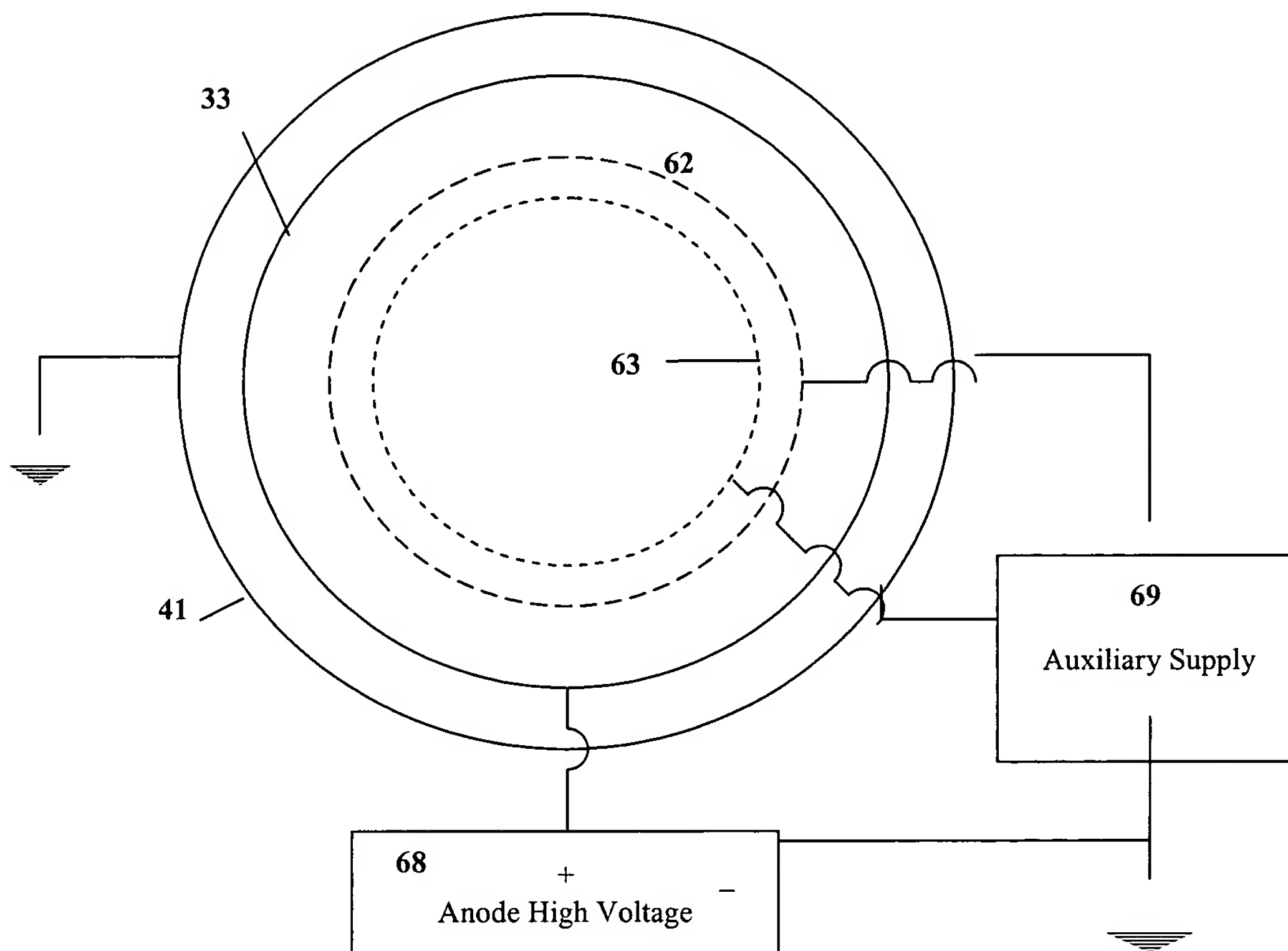


Fig. 26.

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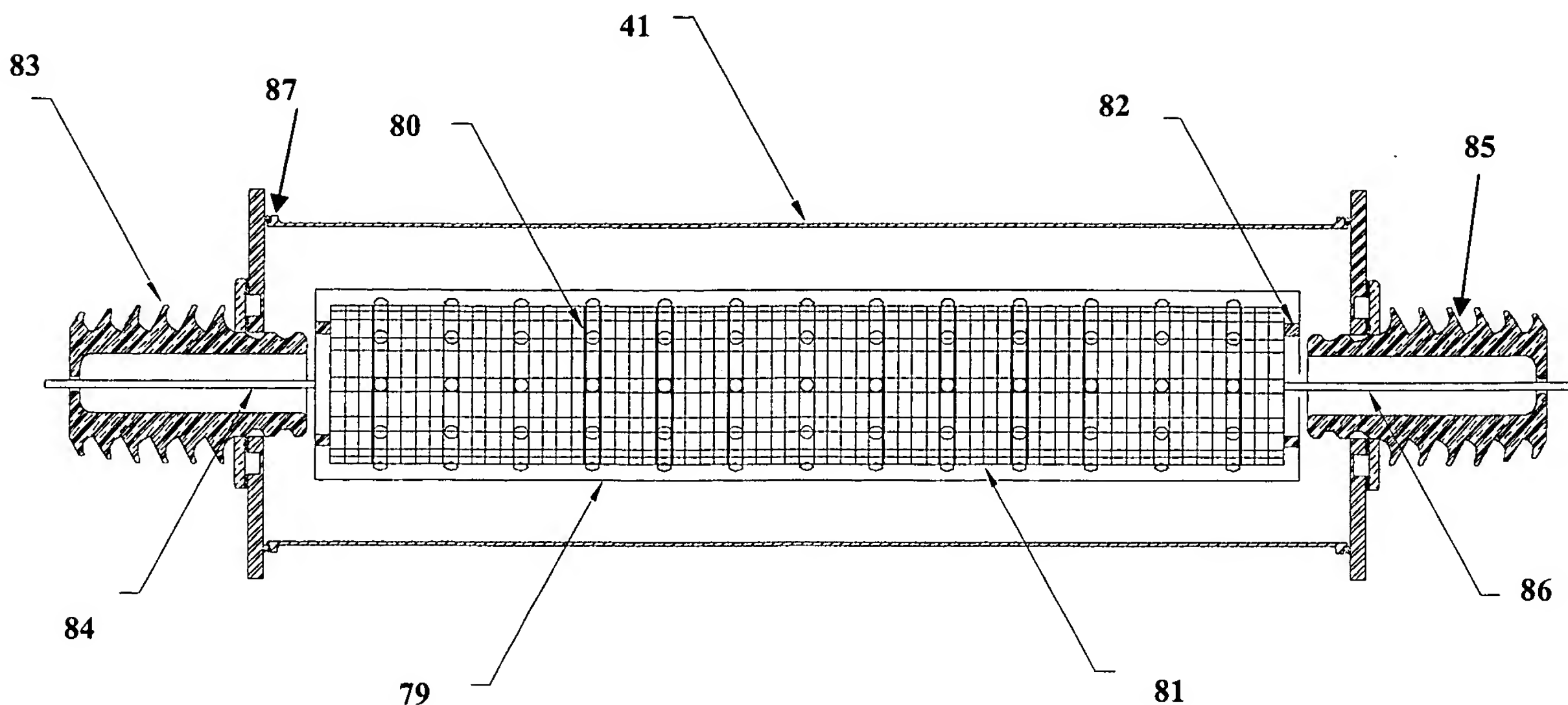


Fig. 27a.

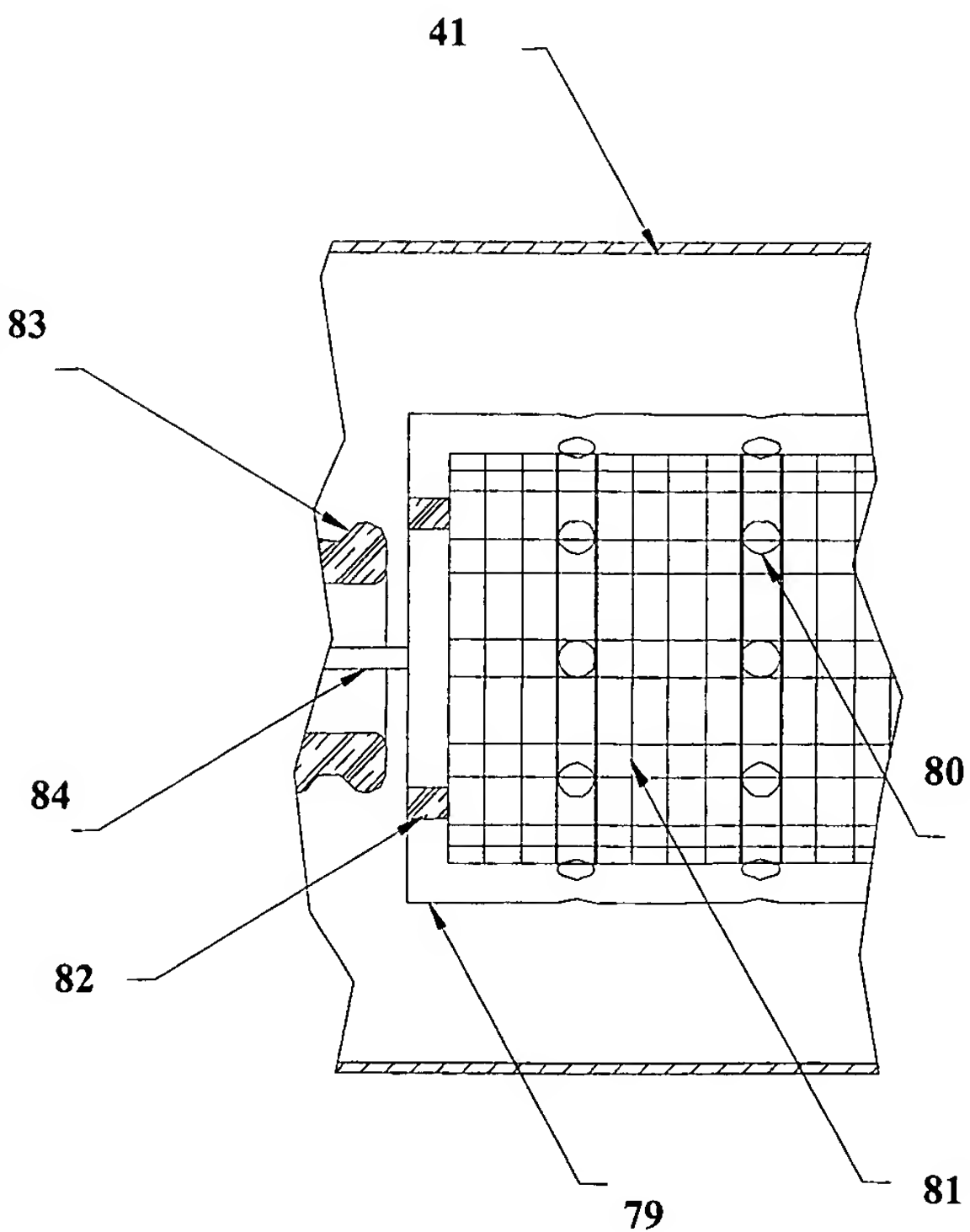


Fig. 27b.

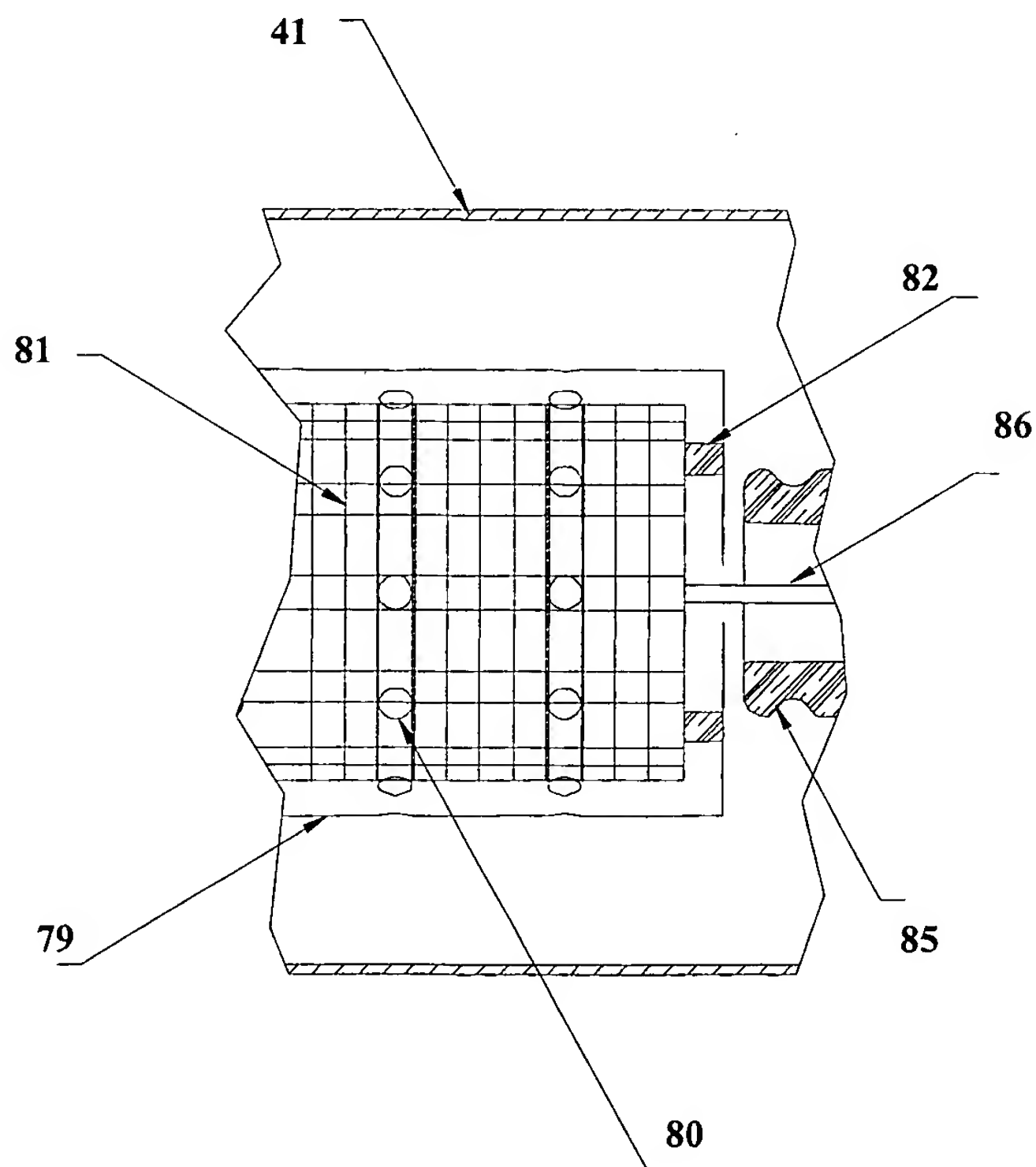


Fig. 27c.

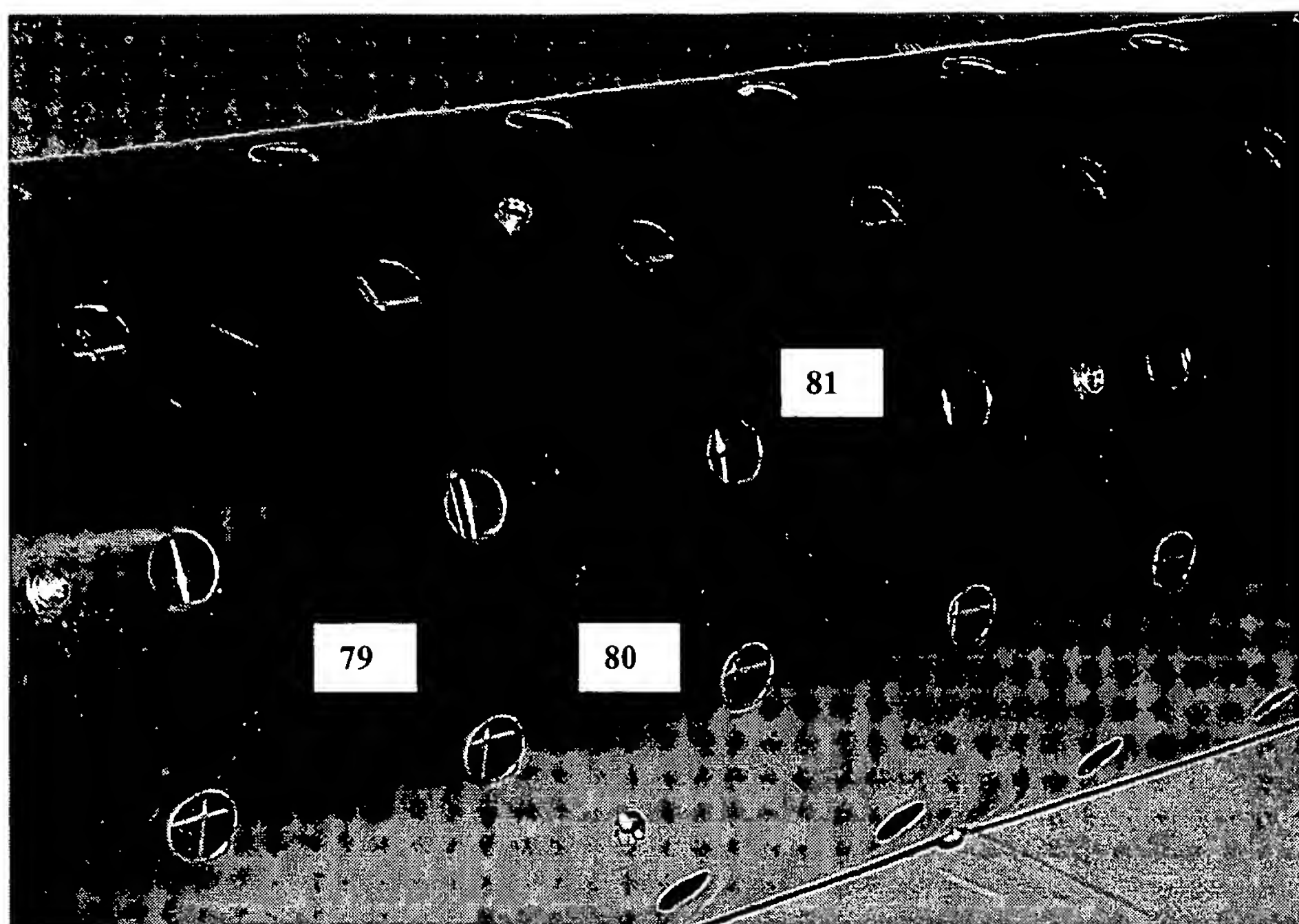


Fig. 28.

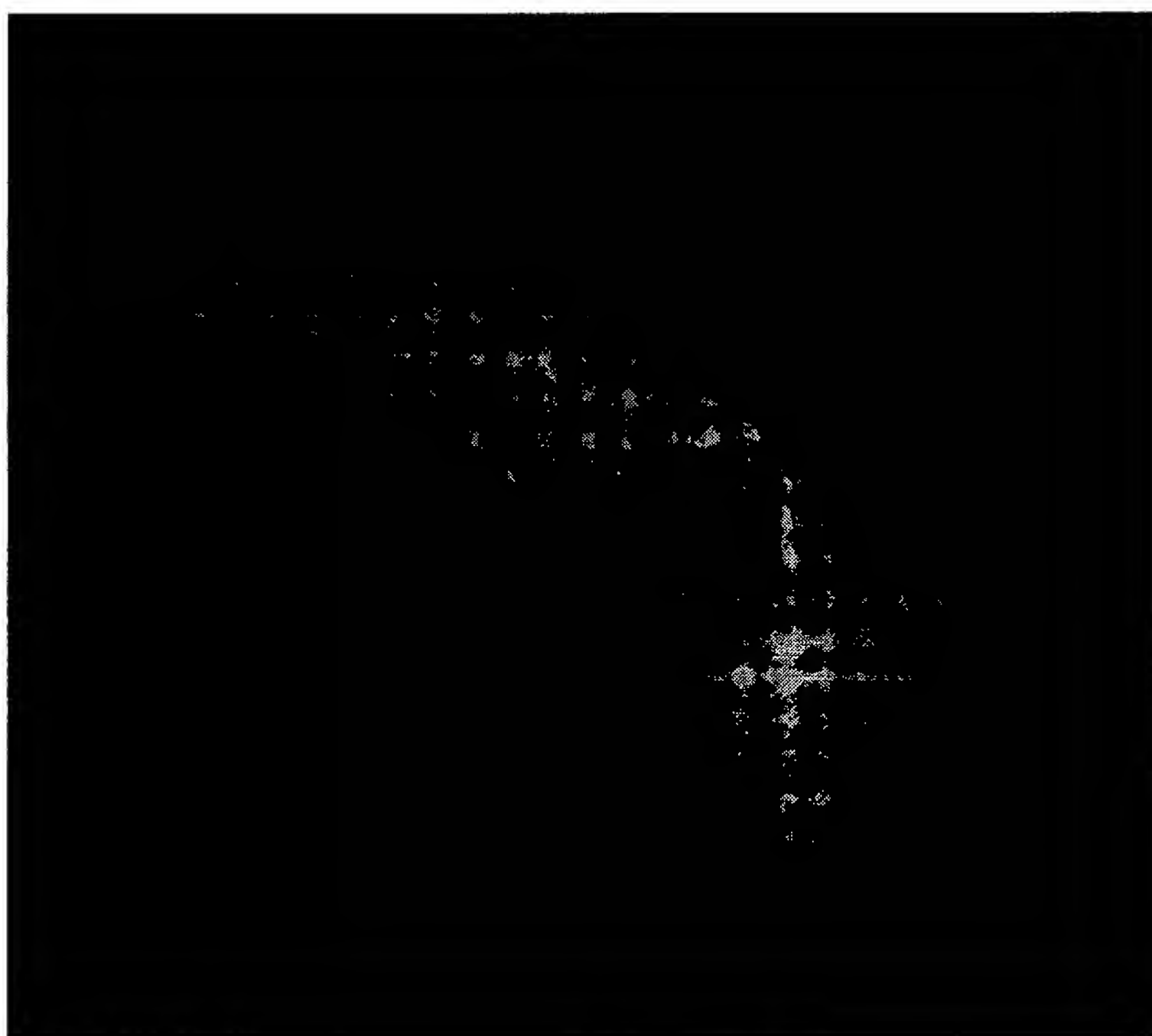


Fig. 29.

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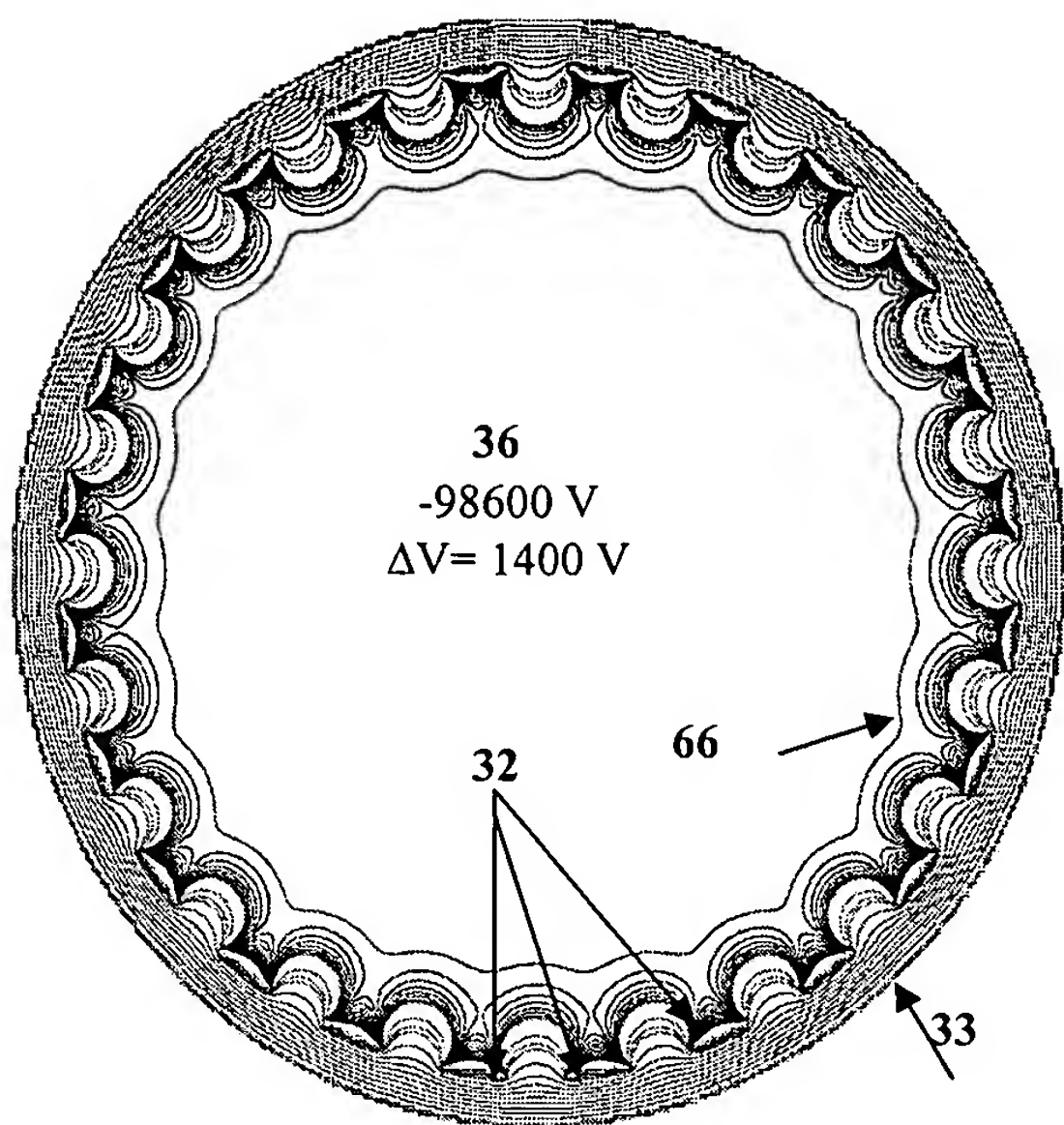


Figure 30a.

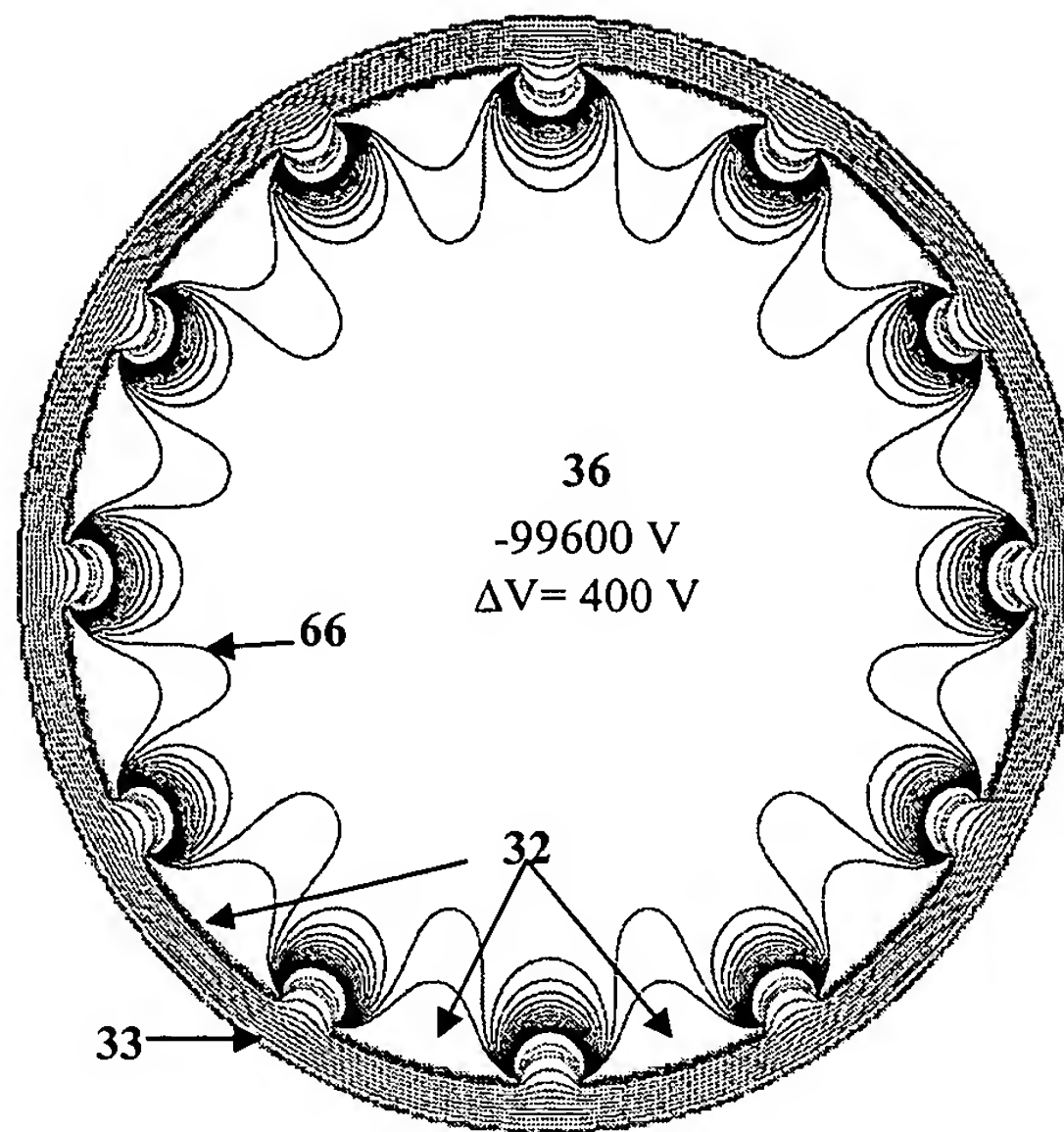


Figure 30b.

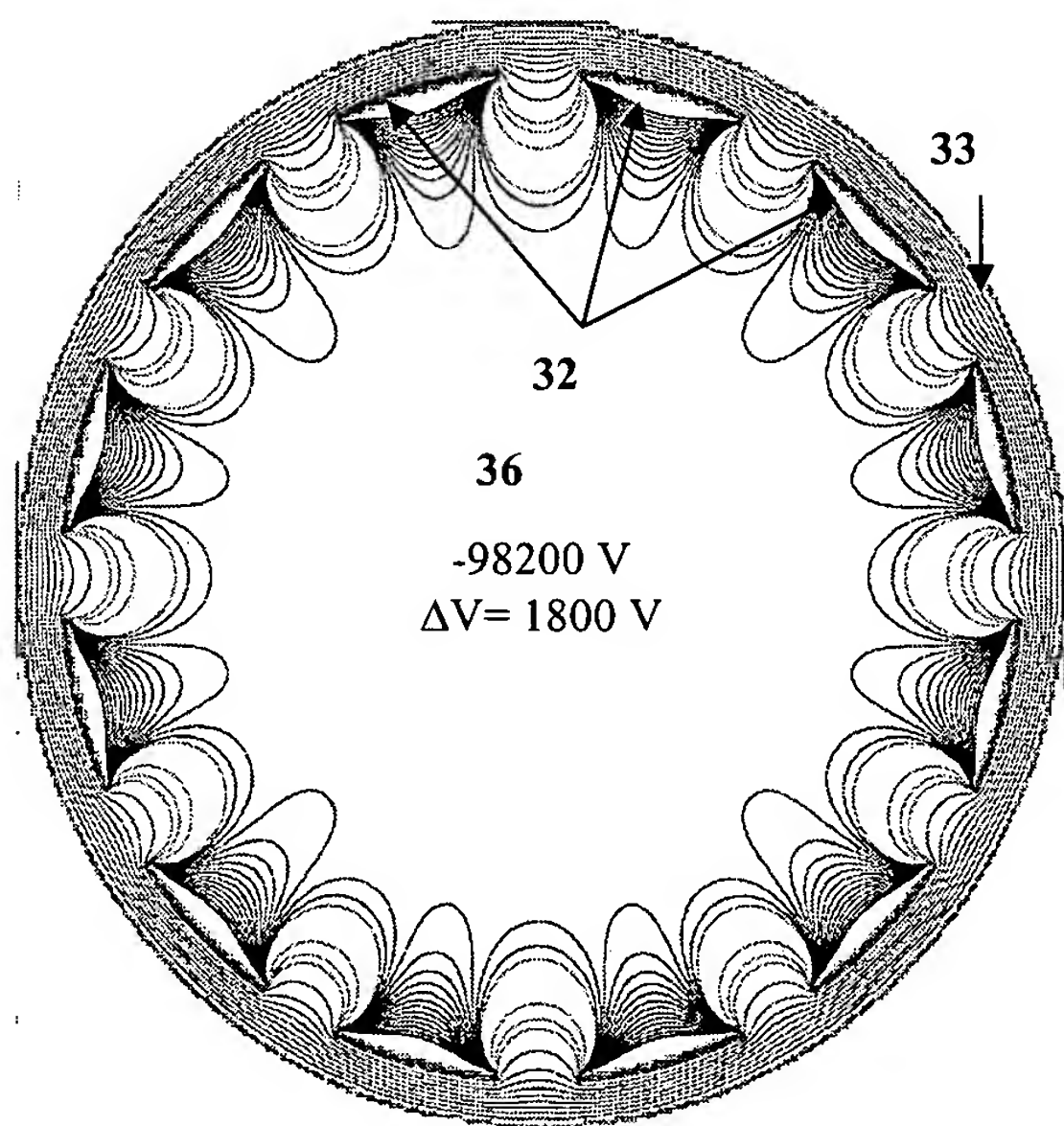


Figure 30c.

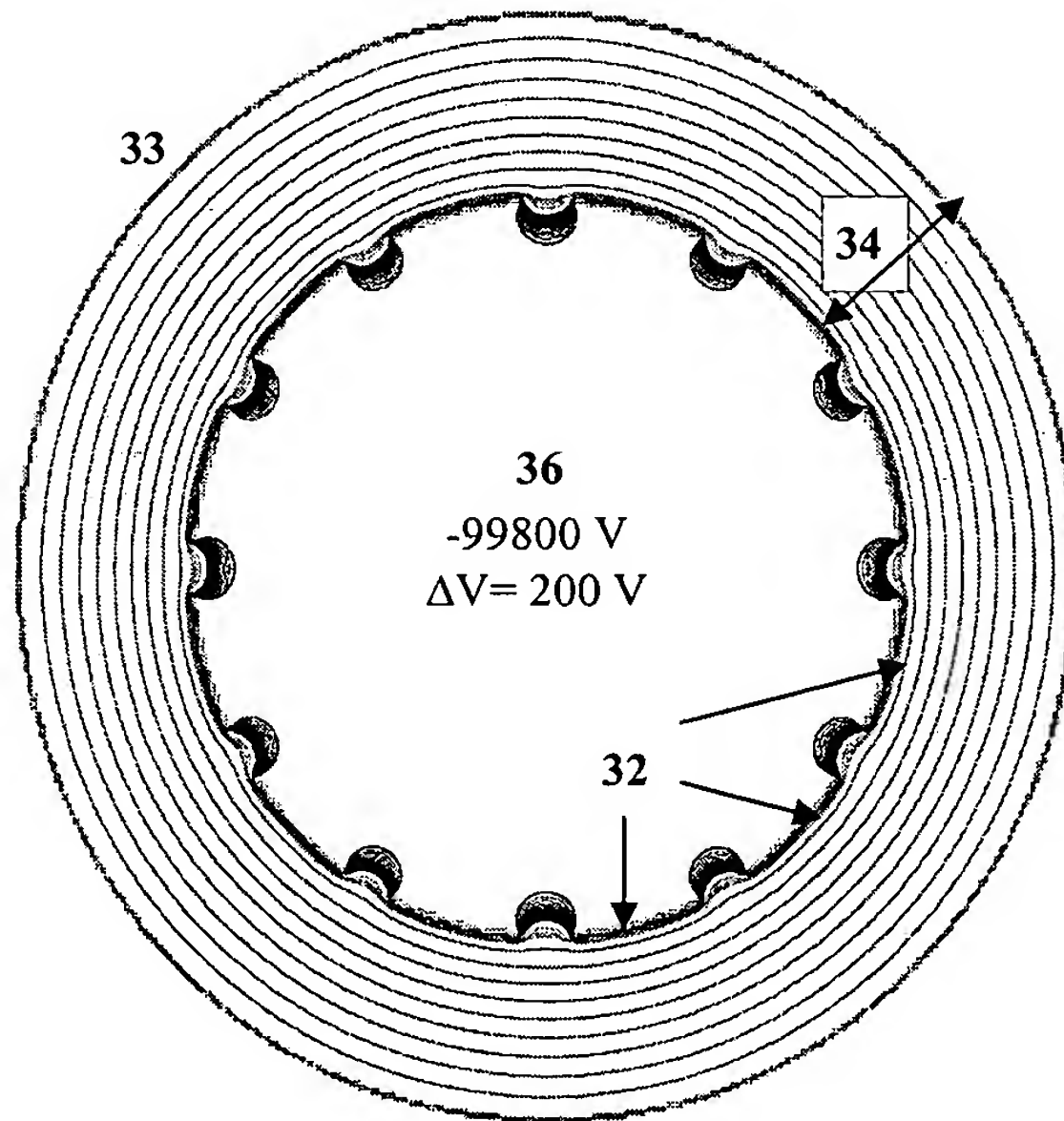


Figure 30d.

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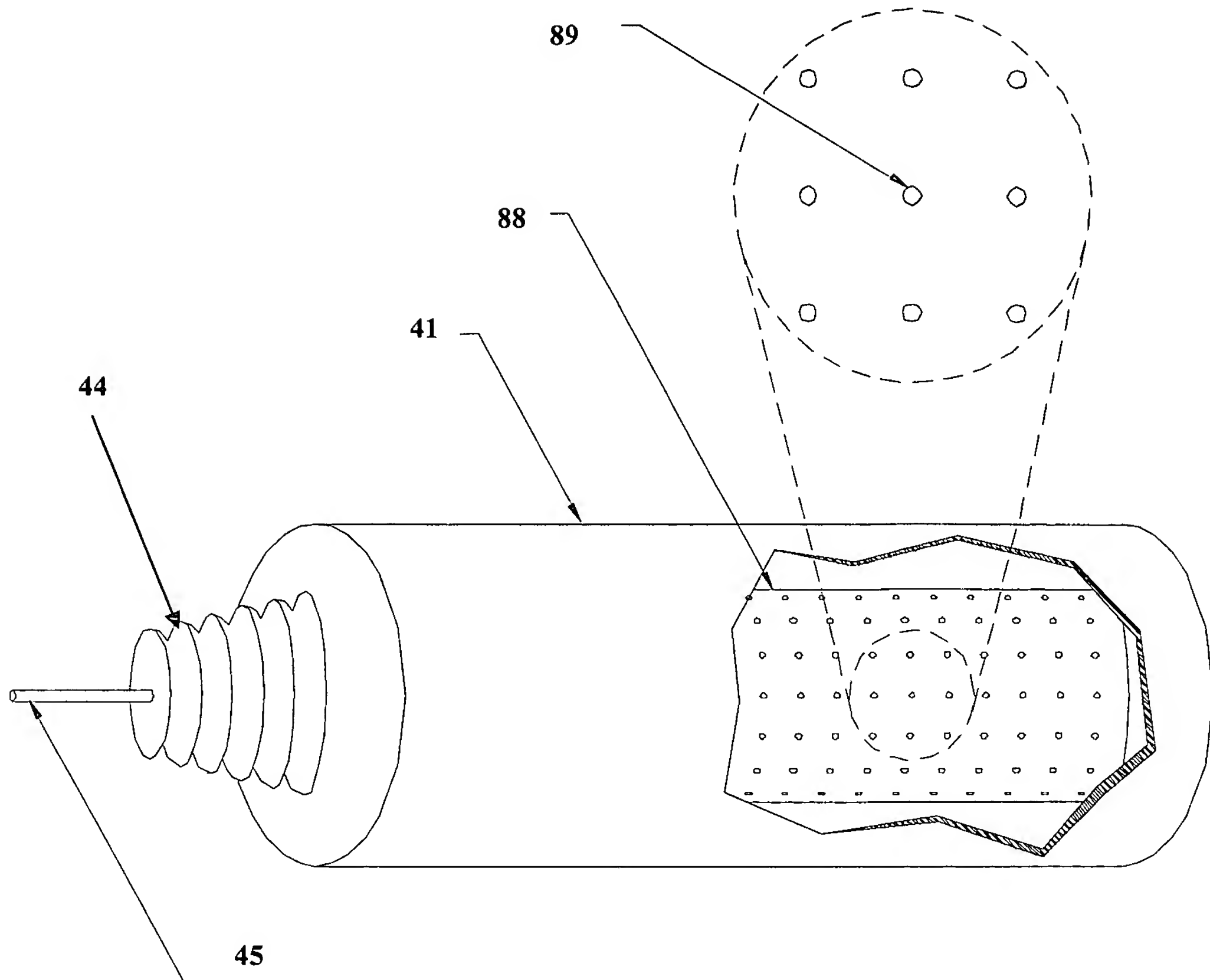


Figure 31.

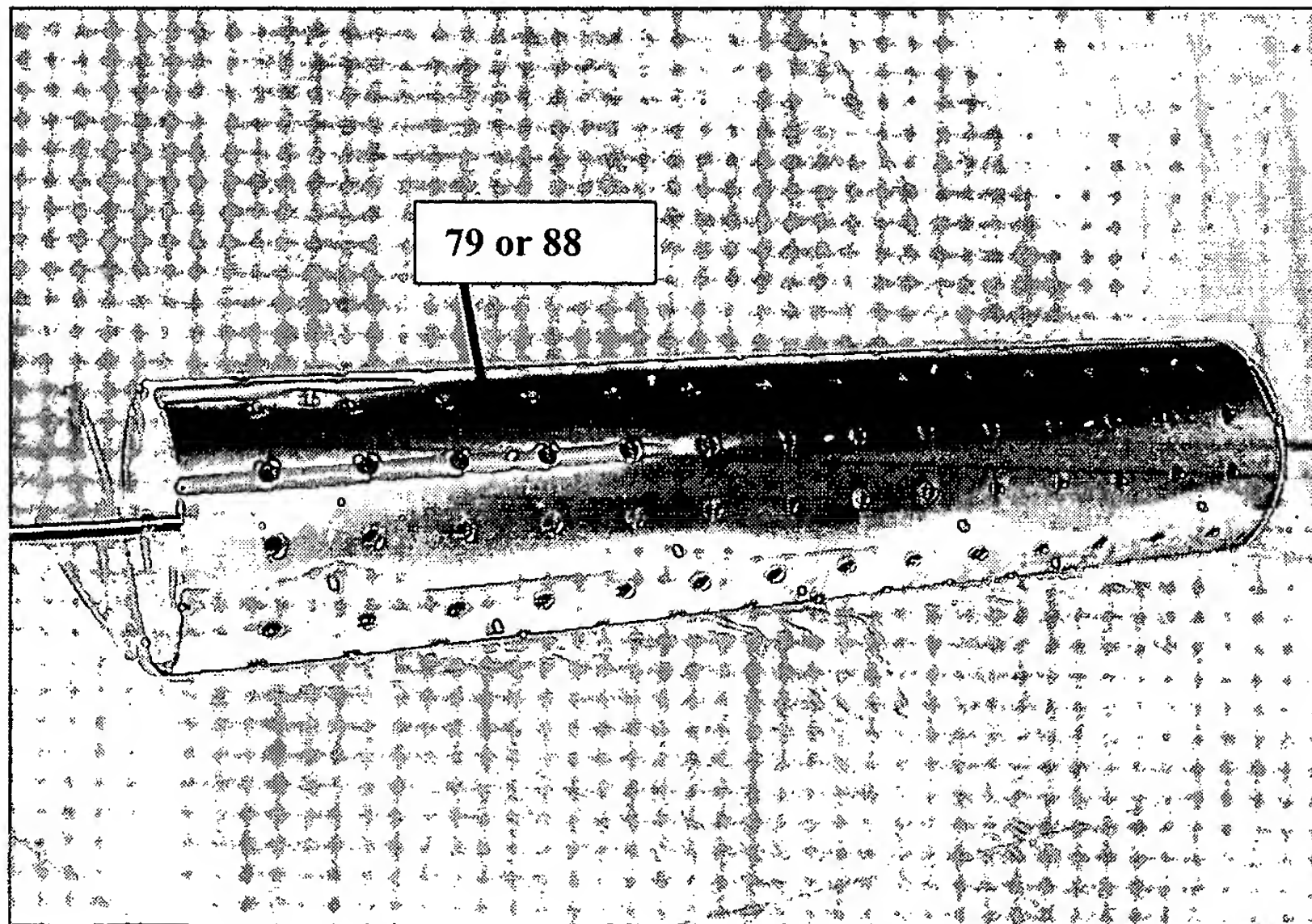


Figure 32.

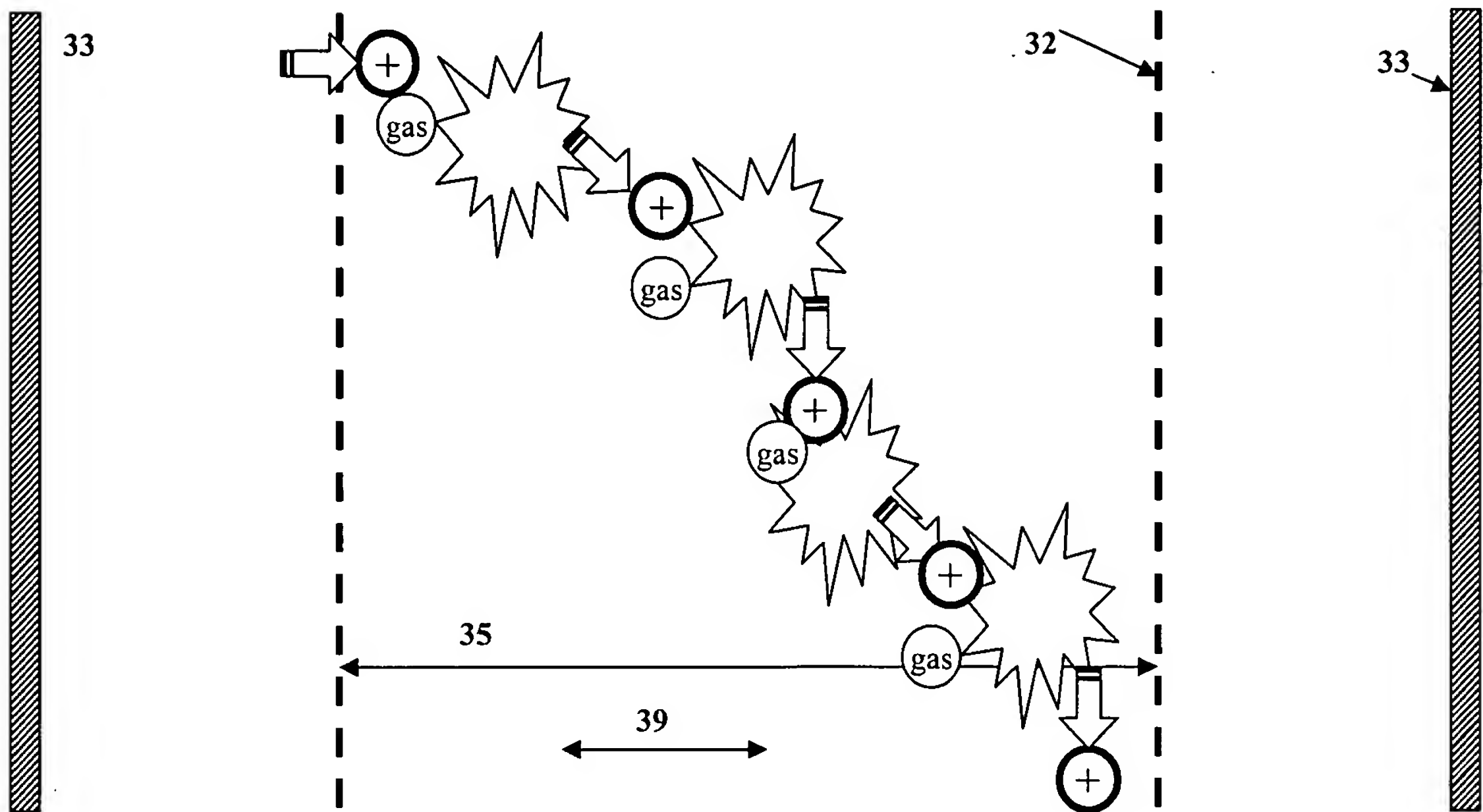


Figure 33a.

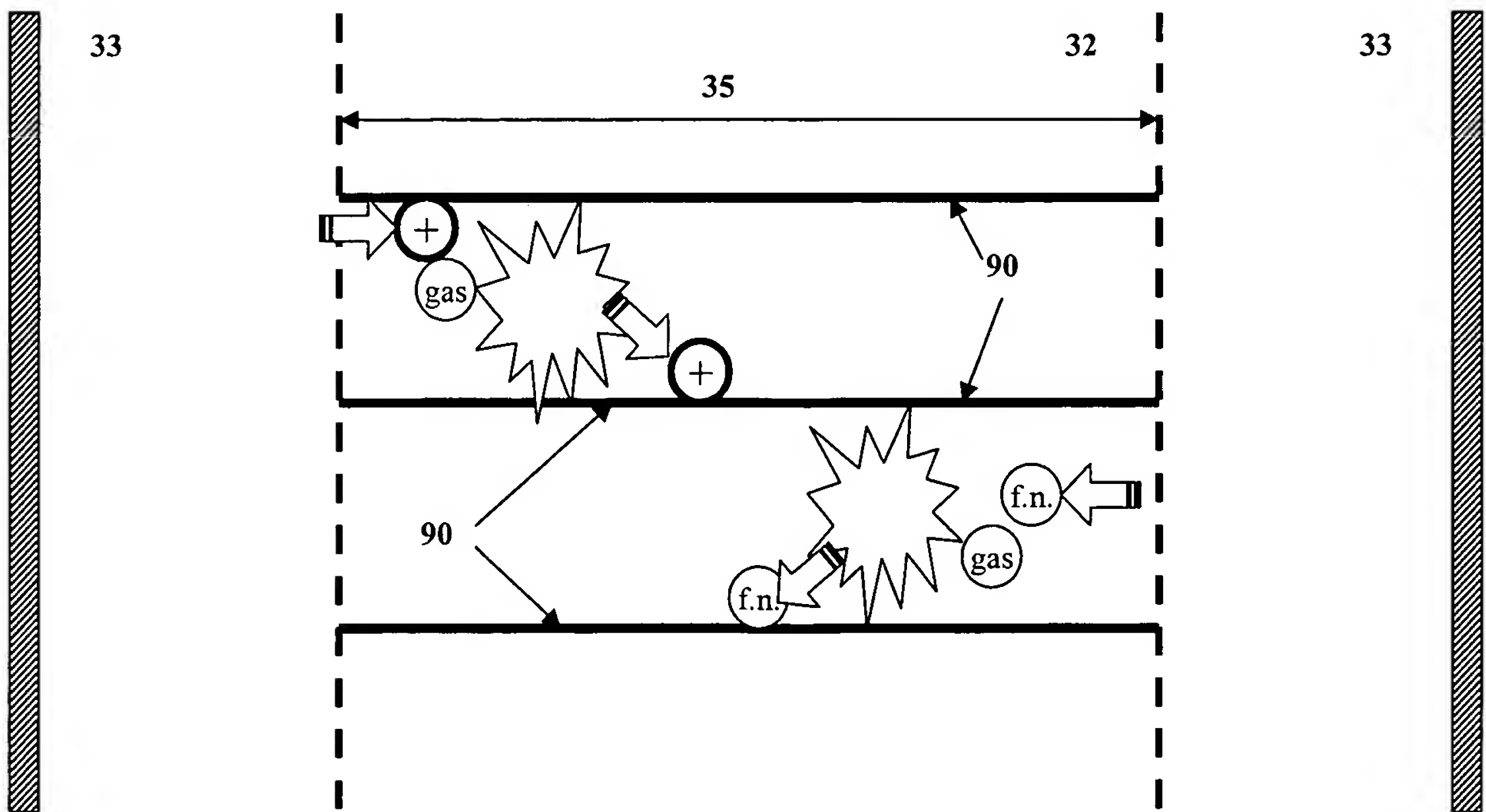


Figure 33b.

10058561.012802

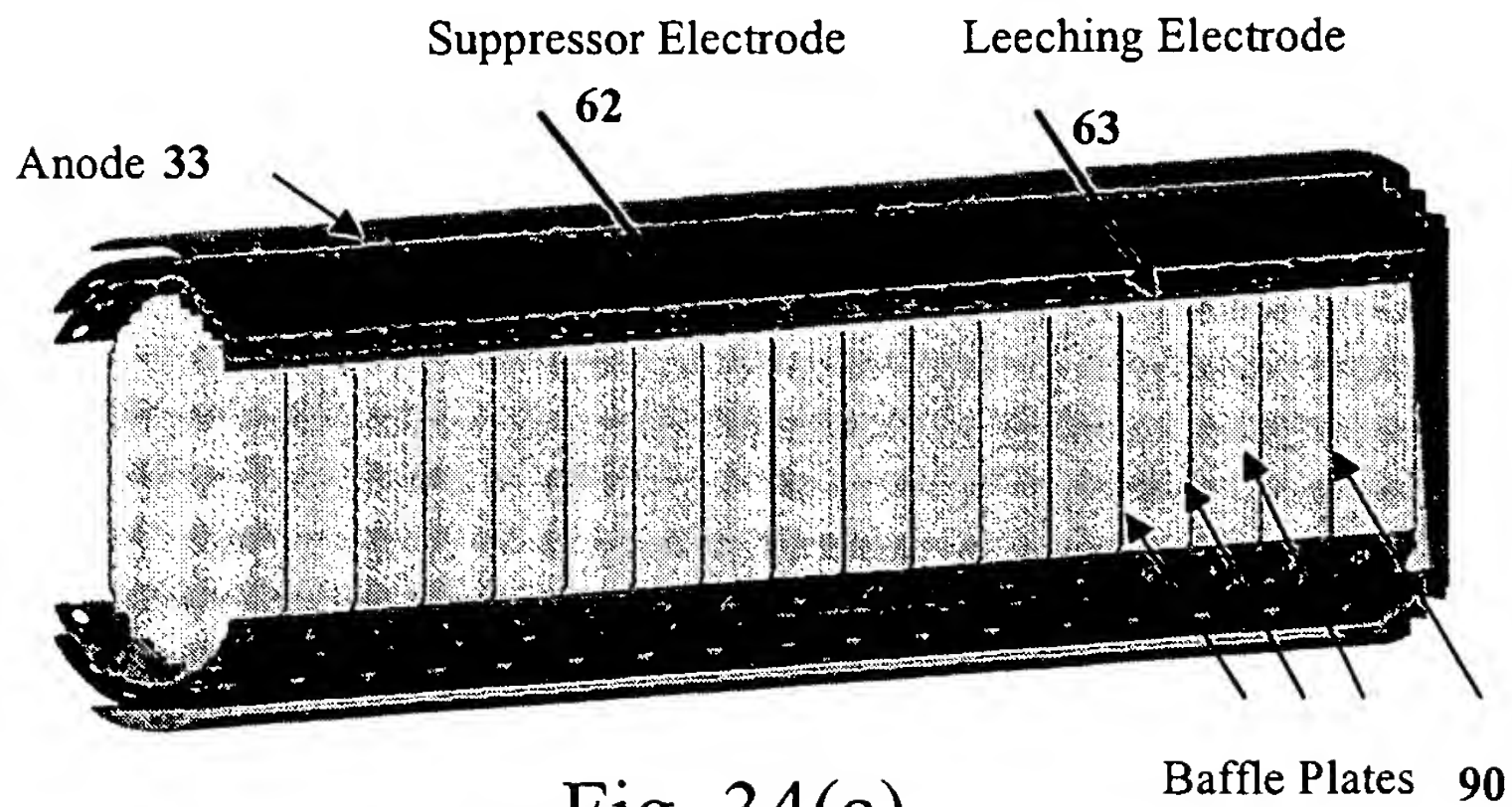


Fig. 34(a).

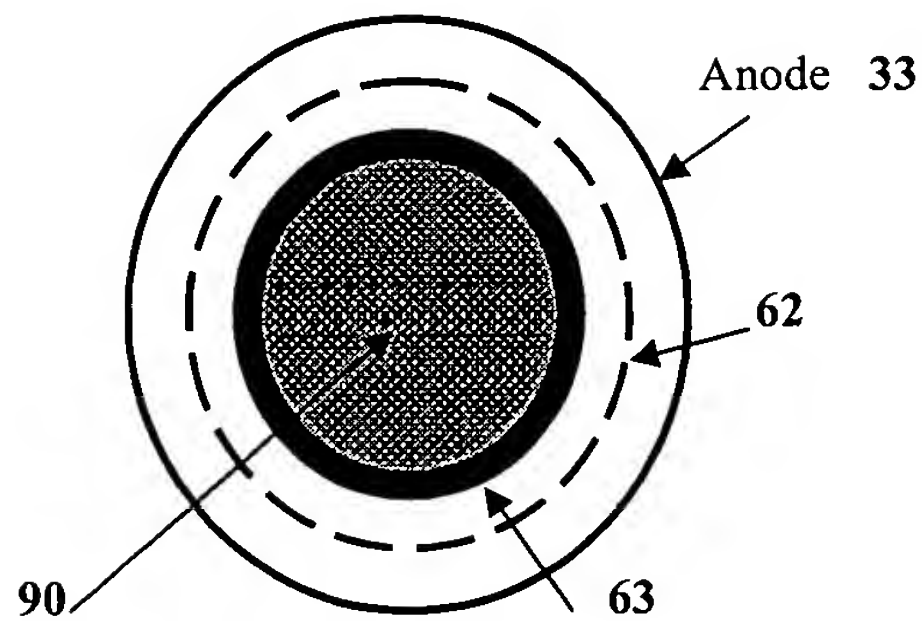


Fig. 34(b).

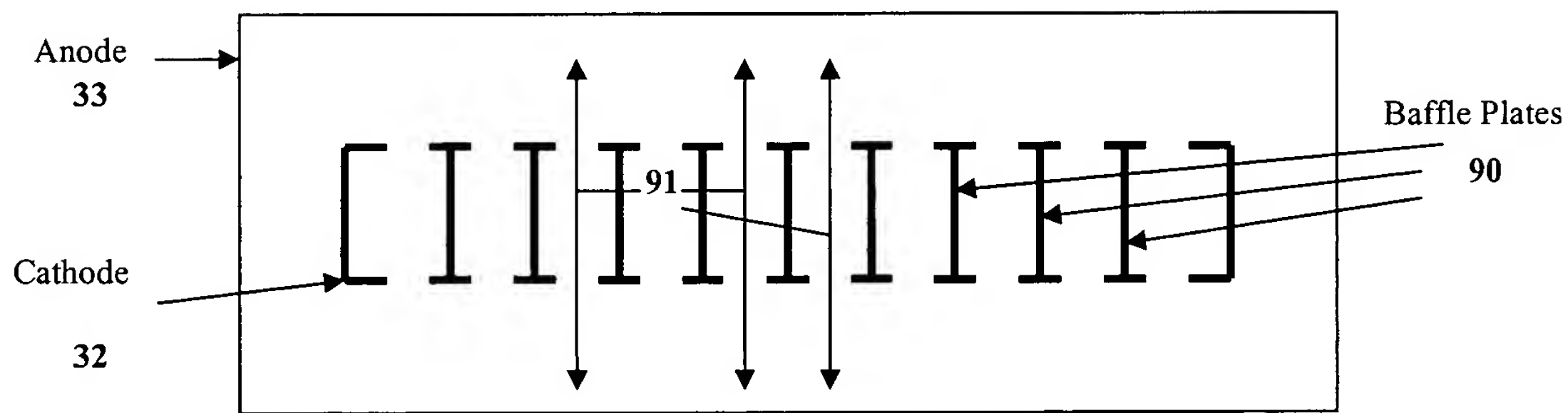


Fig. 35(a).

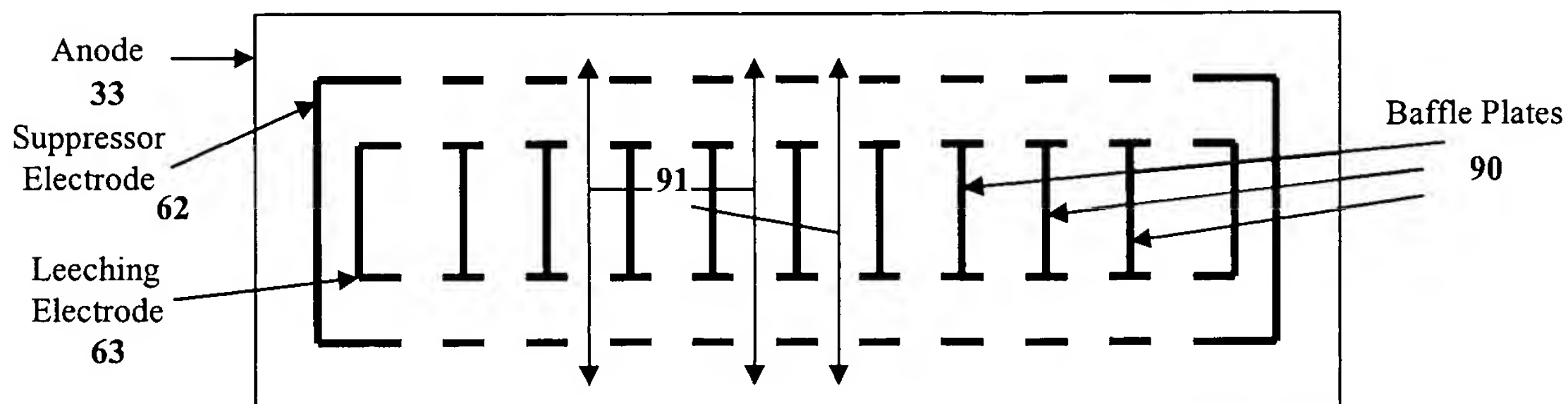


Fig. 35(b).

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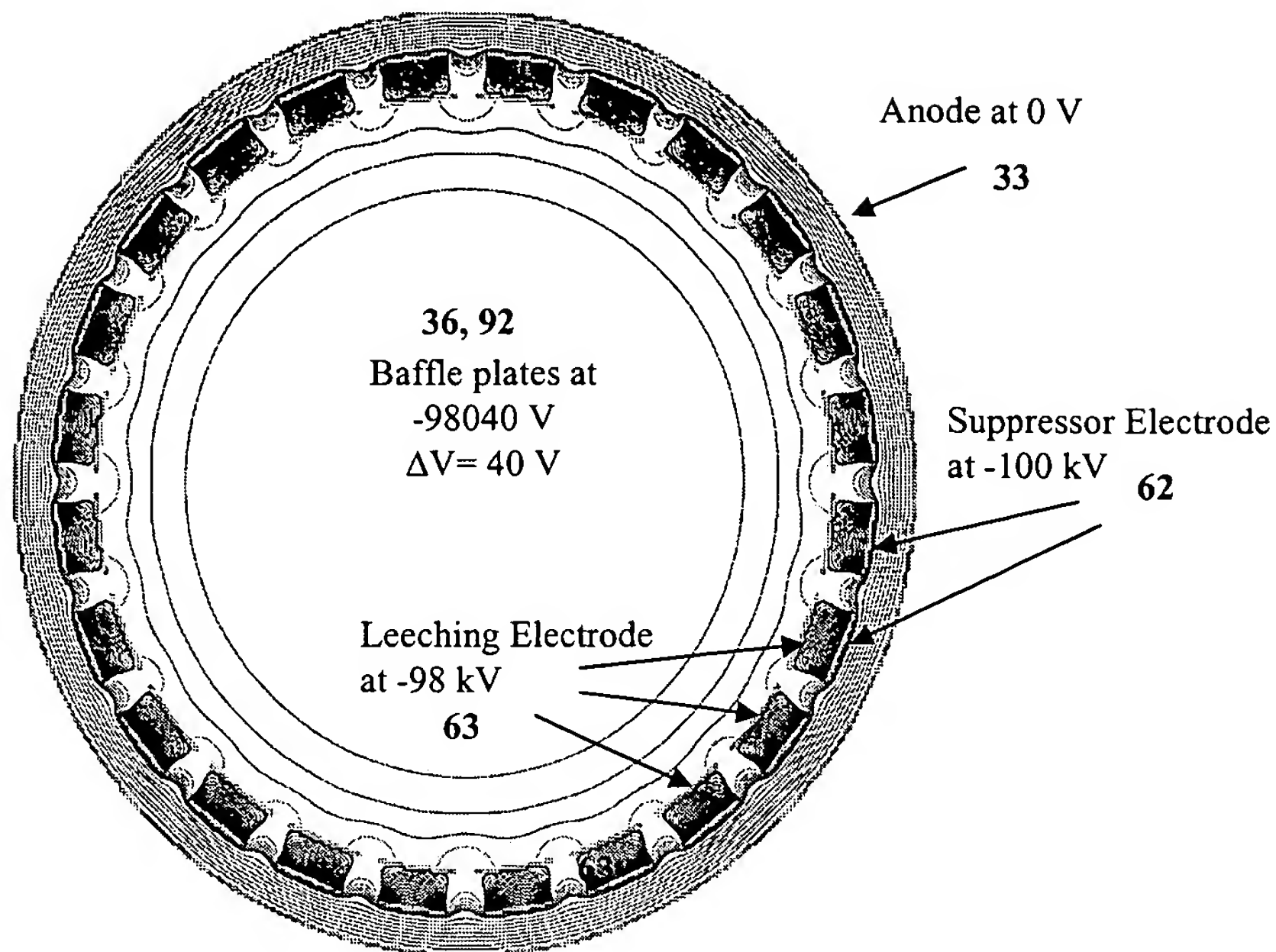


Figure 36.

10058561-012806

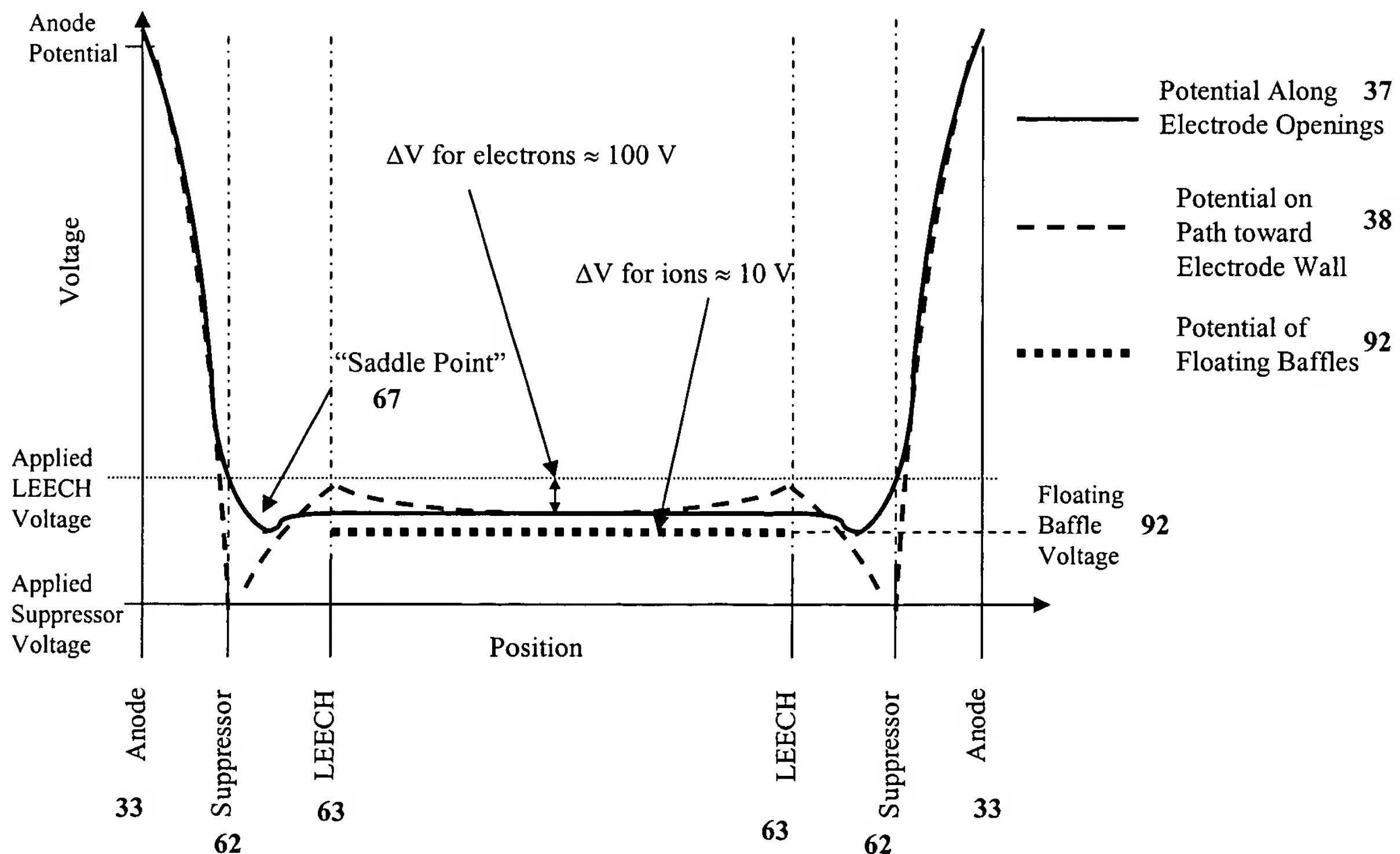


Fig. 37.

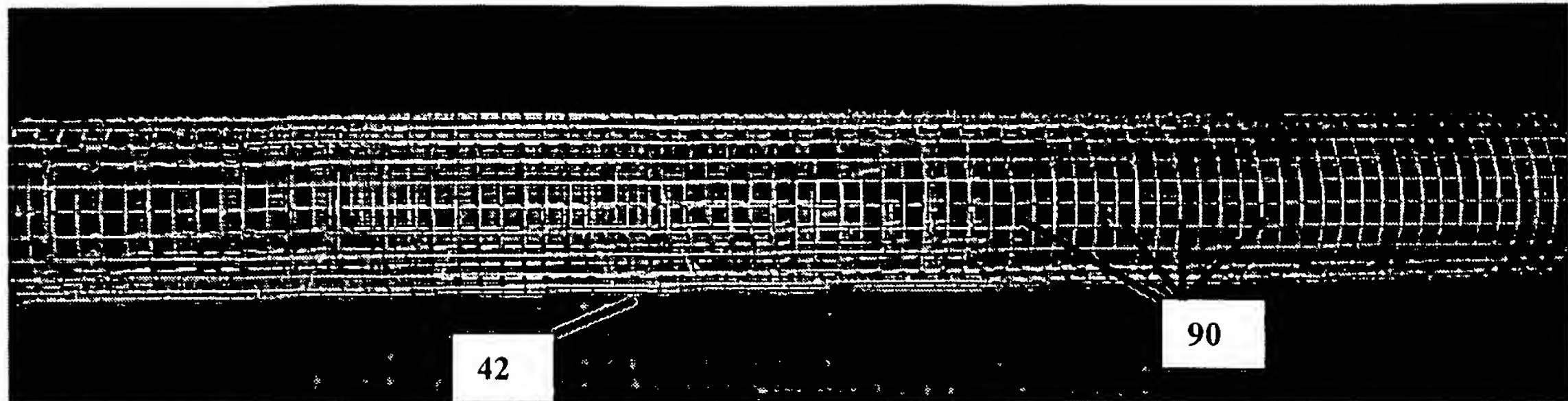


Fig. 38.

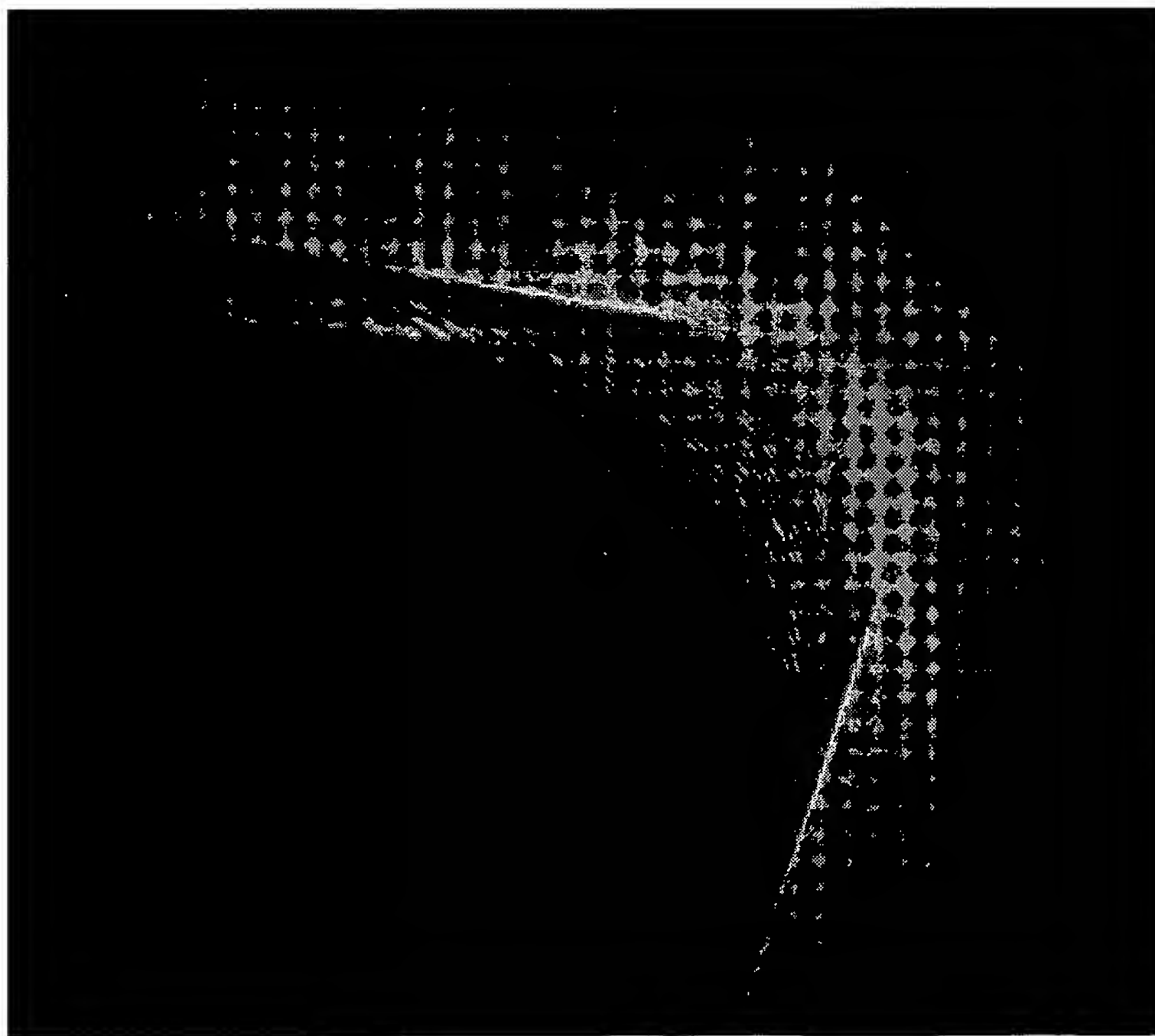


Fig. 39.

10058561-012300

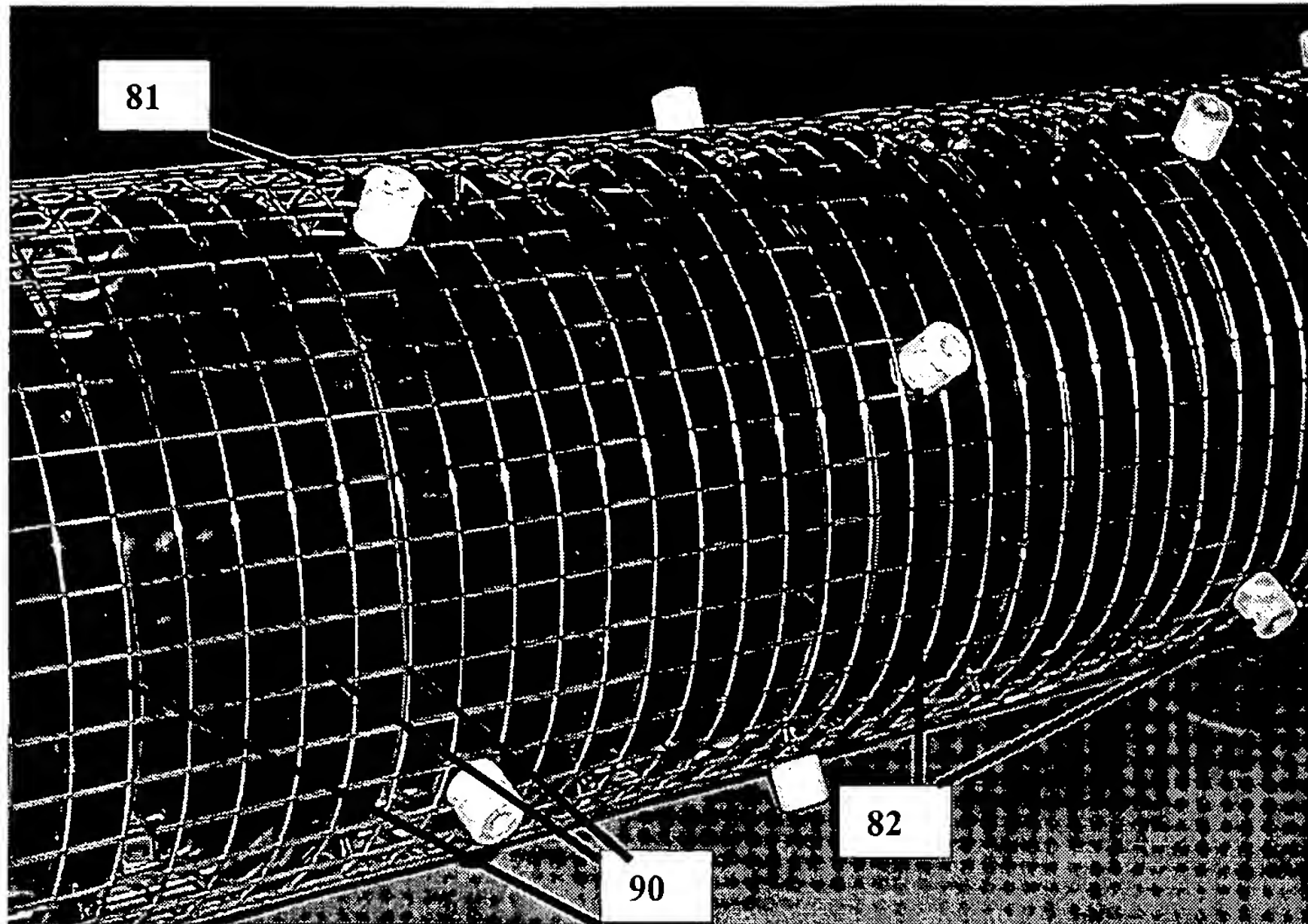
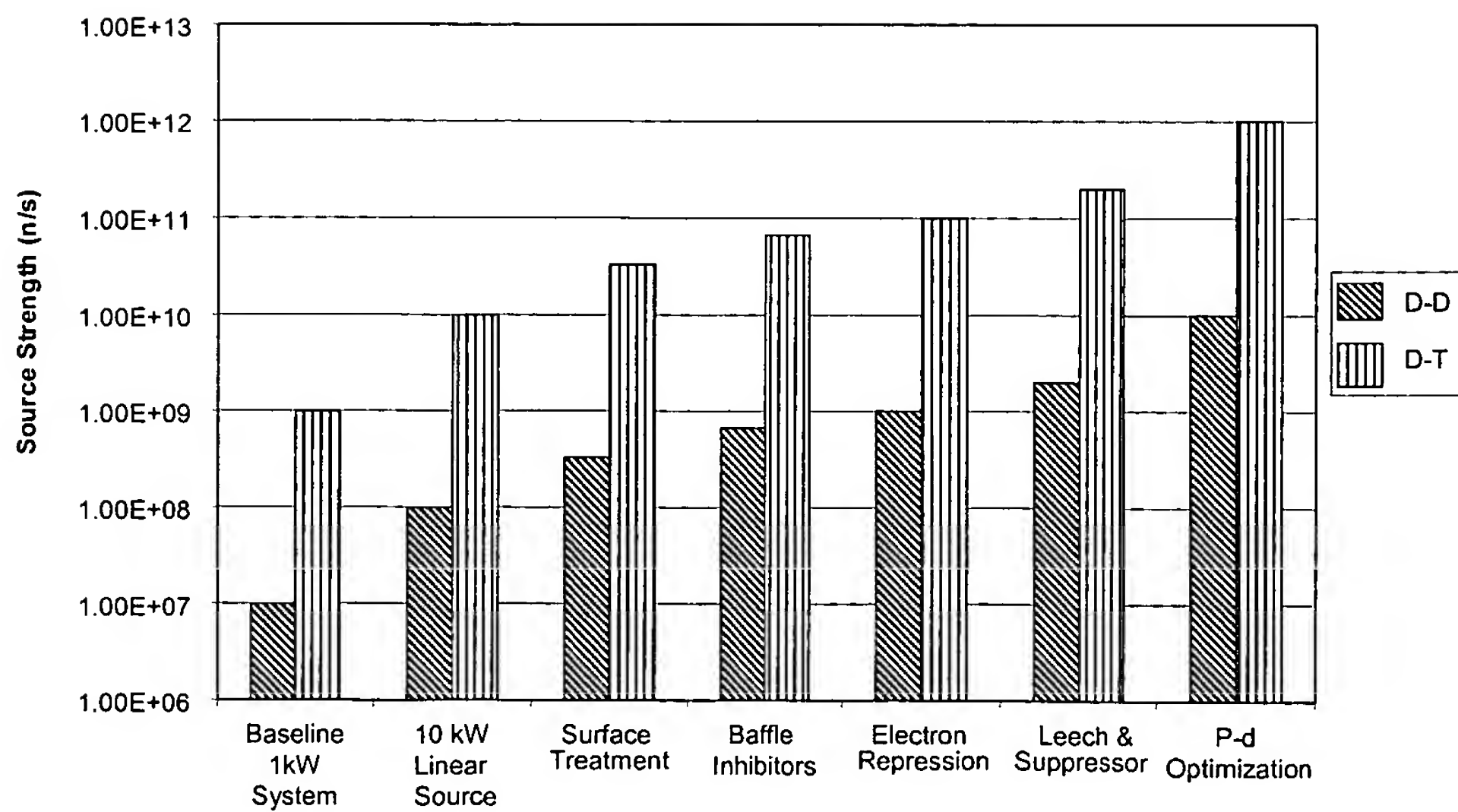


Fig. 40.



Technical Innovations

Fig. 41.

1065361-012002

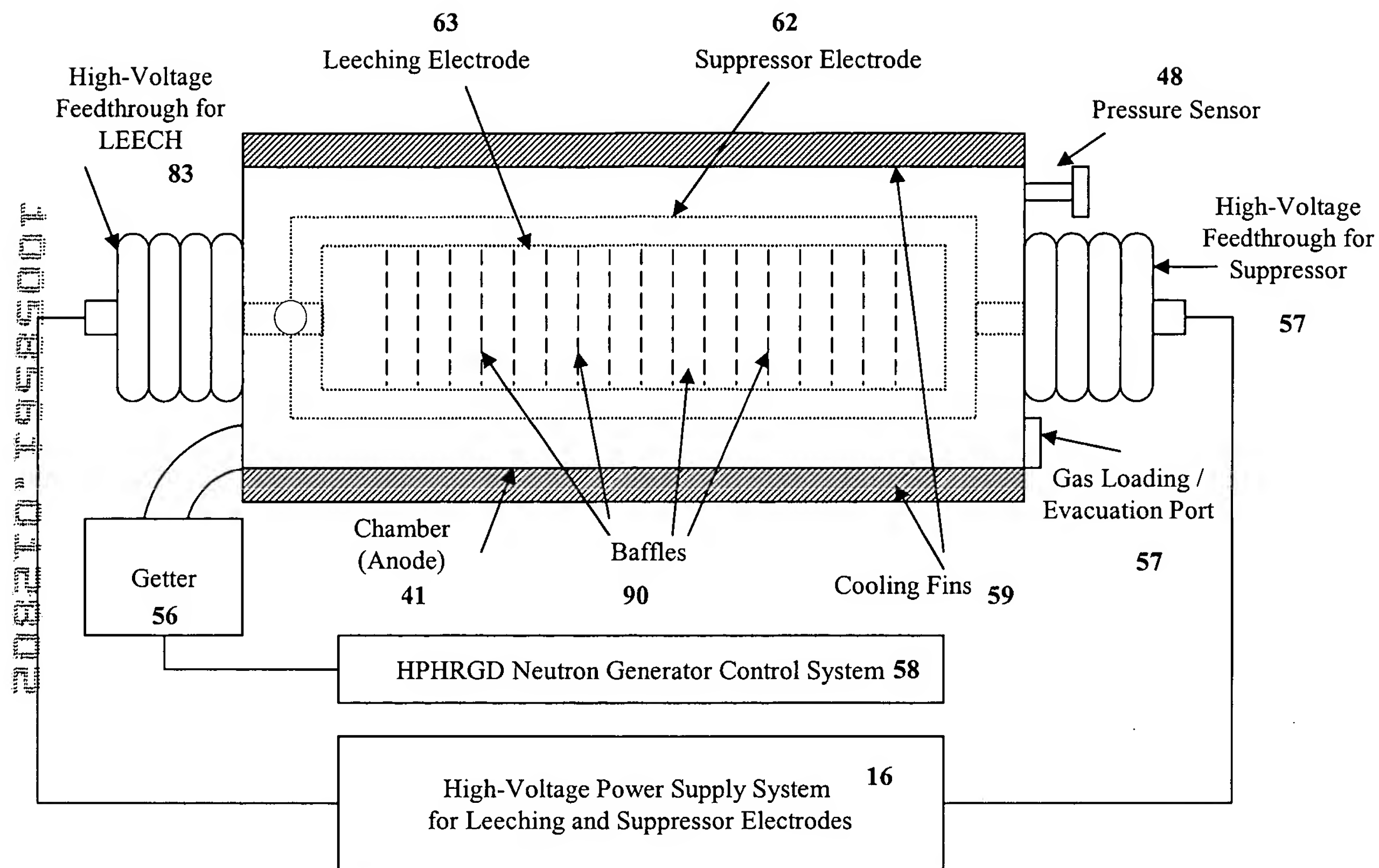


Fig. 42.

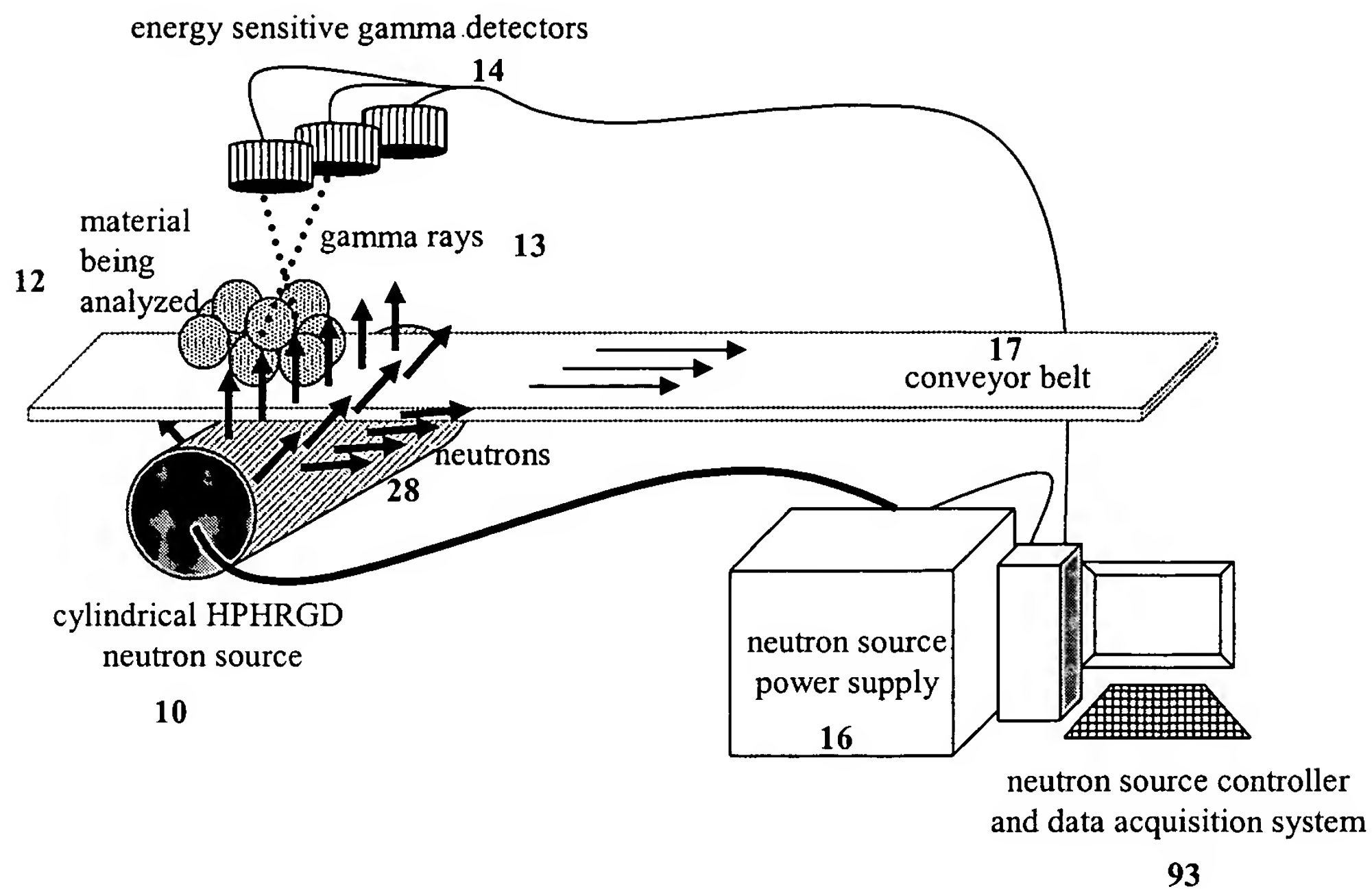


Fig. 43.

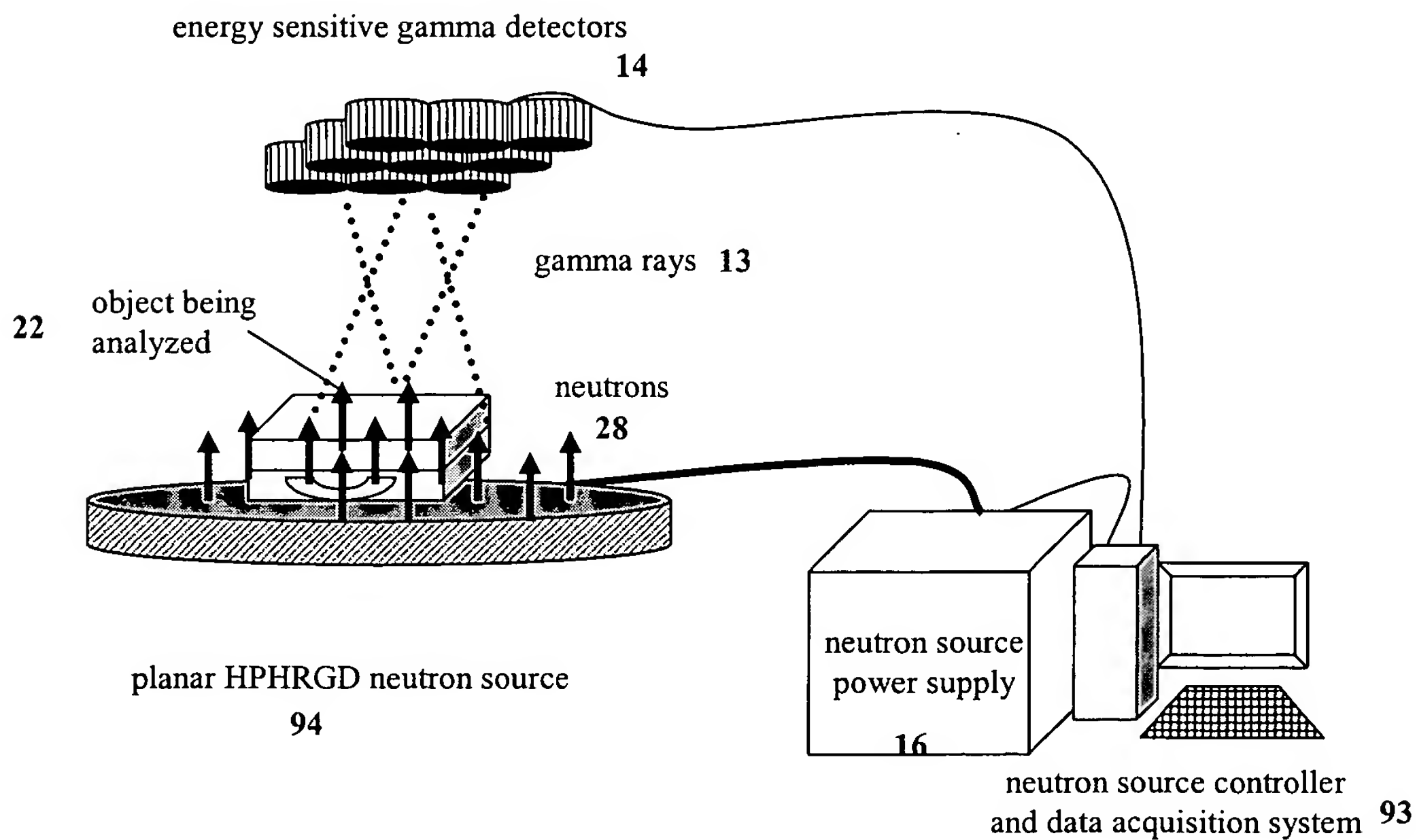


Fig. 44.

10058561-018002

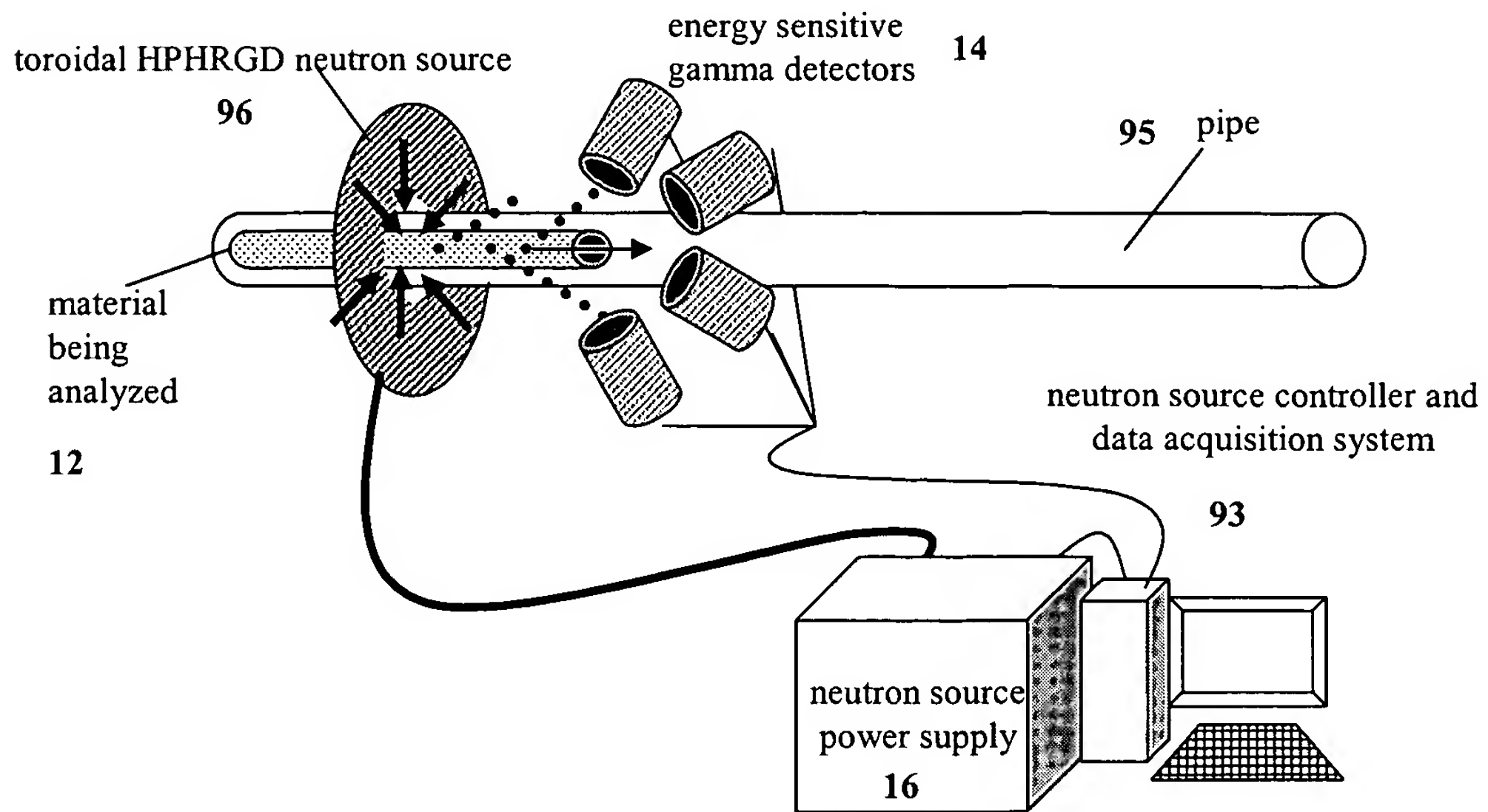


Fig. 45.

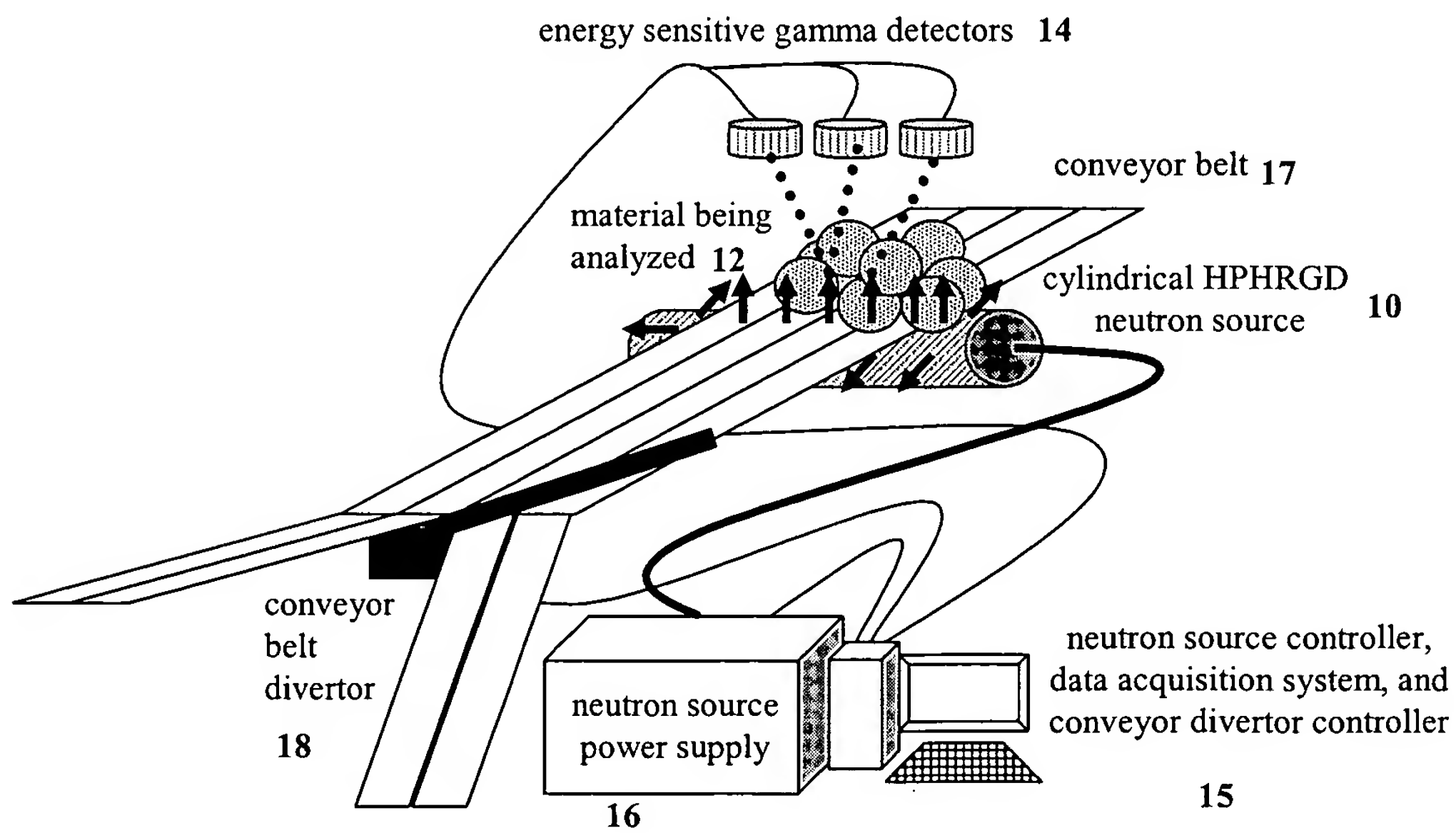


Fig. 46.

10058961-043002

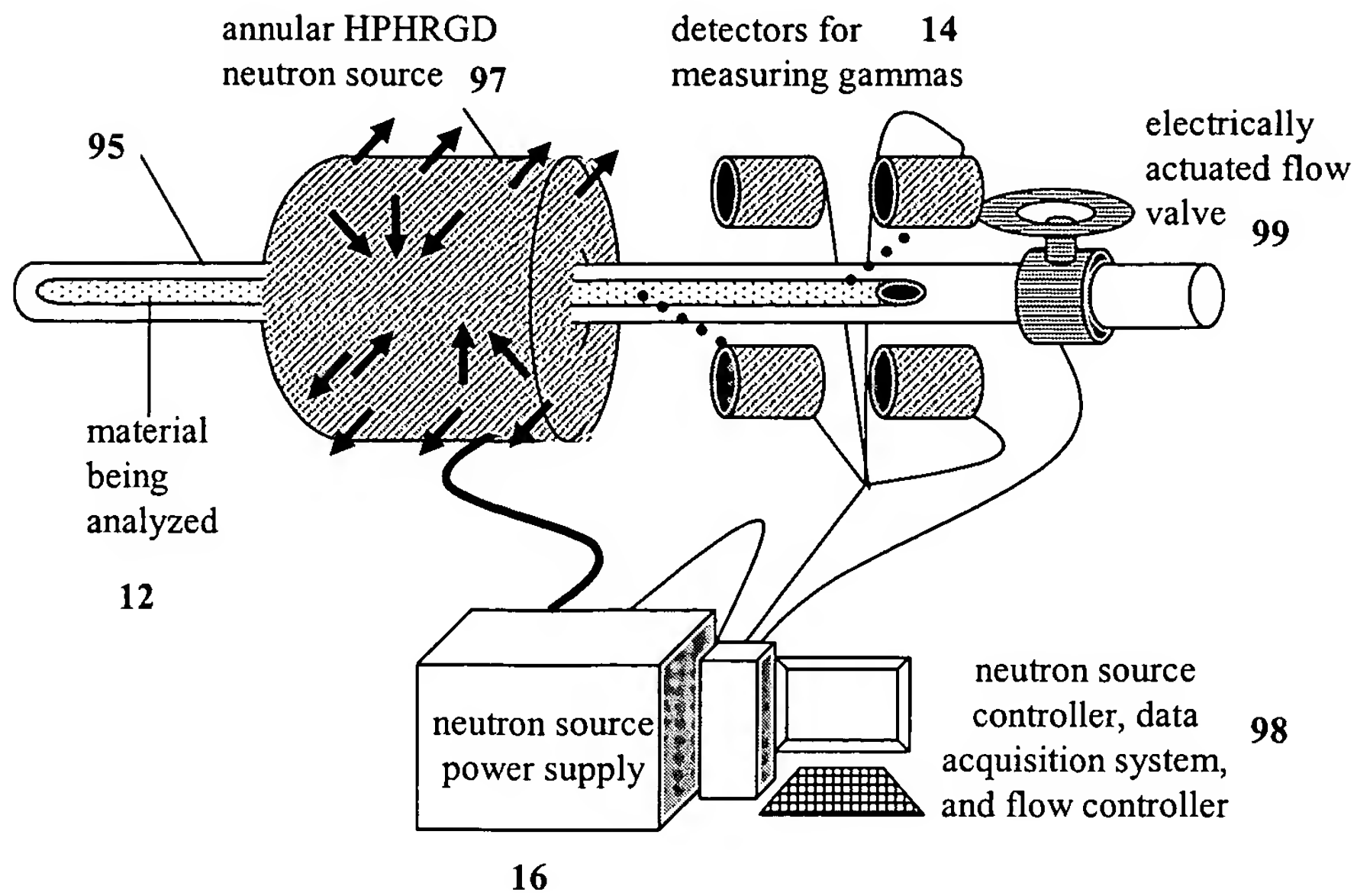


Fig. 47.

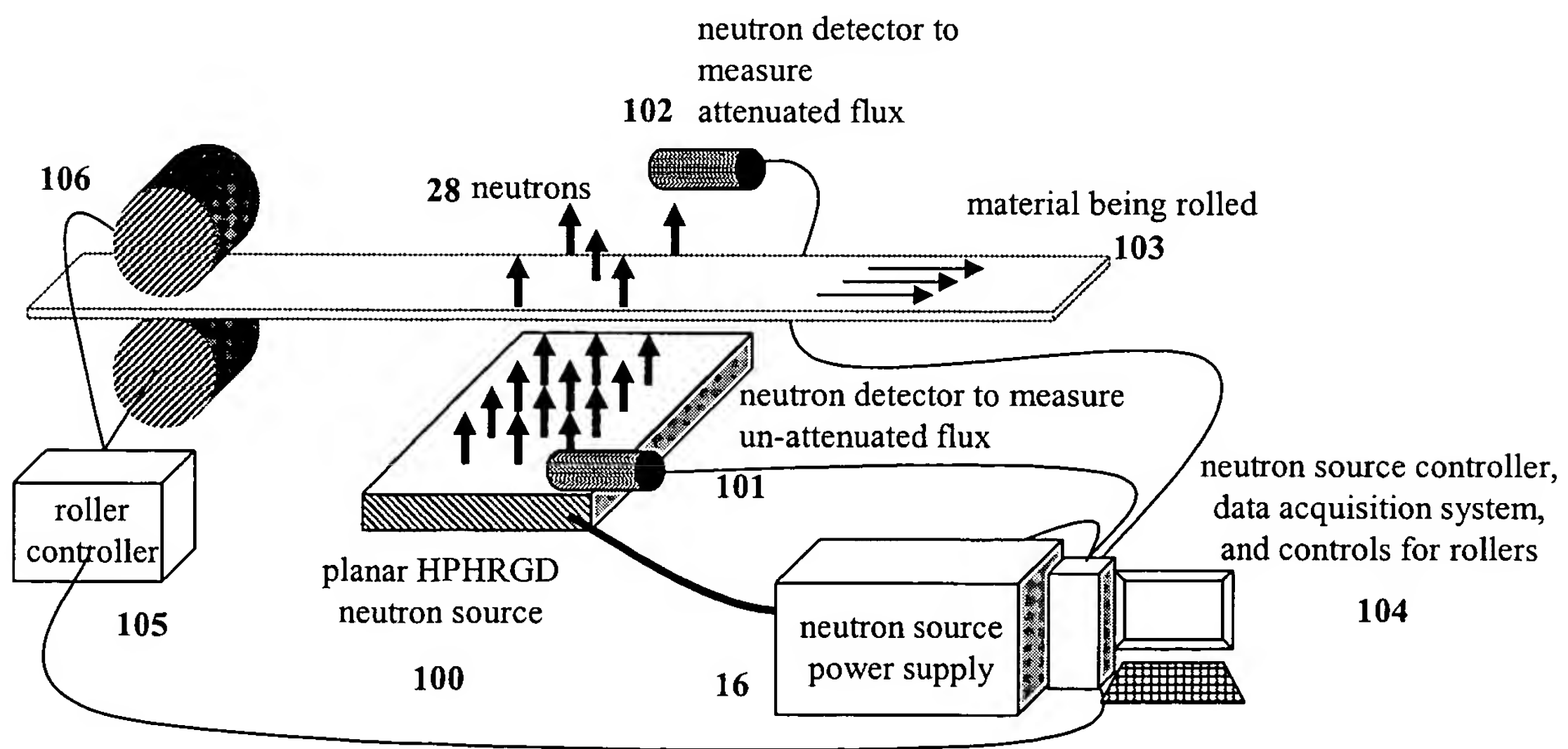


Fig. 48.

10058961.012902

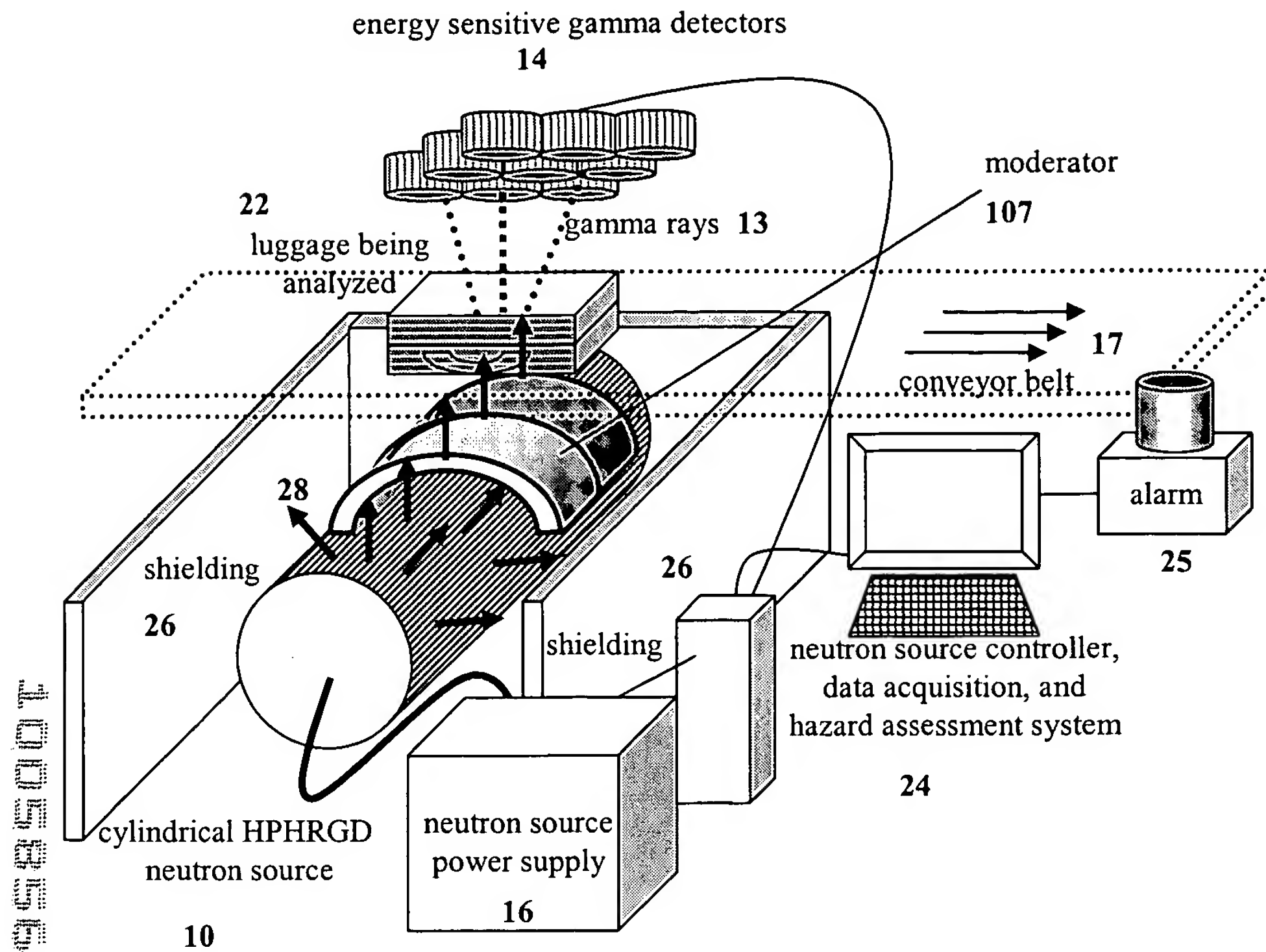


Fig. 49.

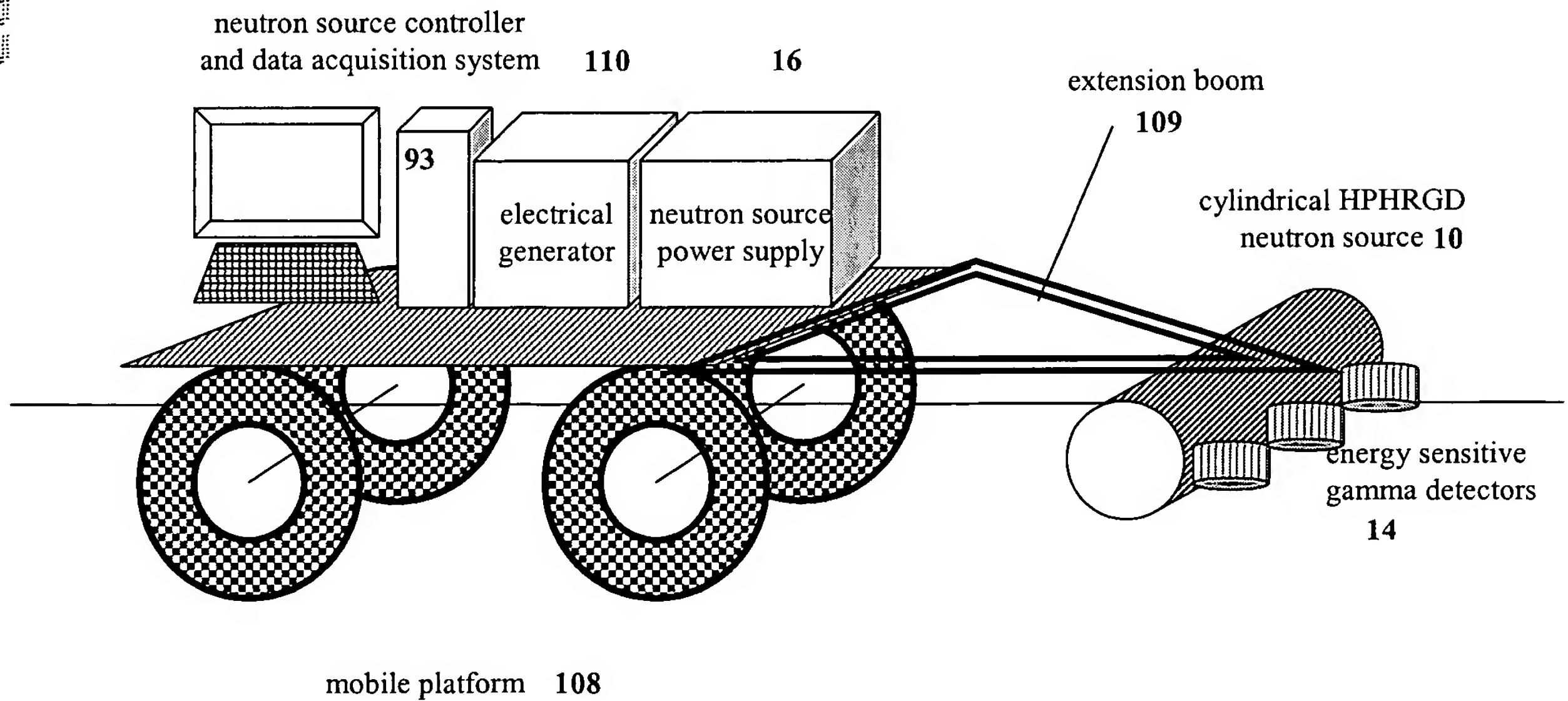


Fig. 50.

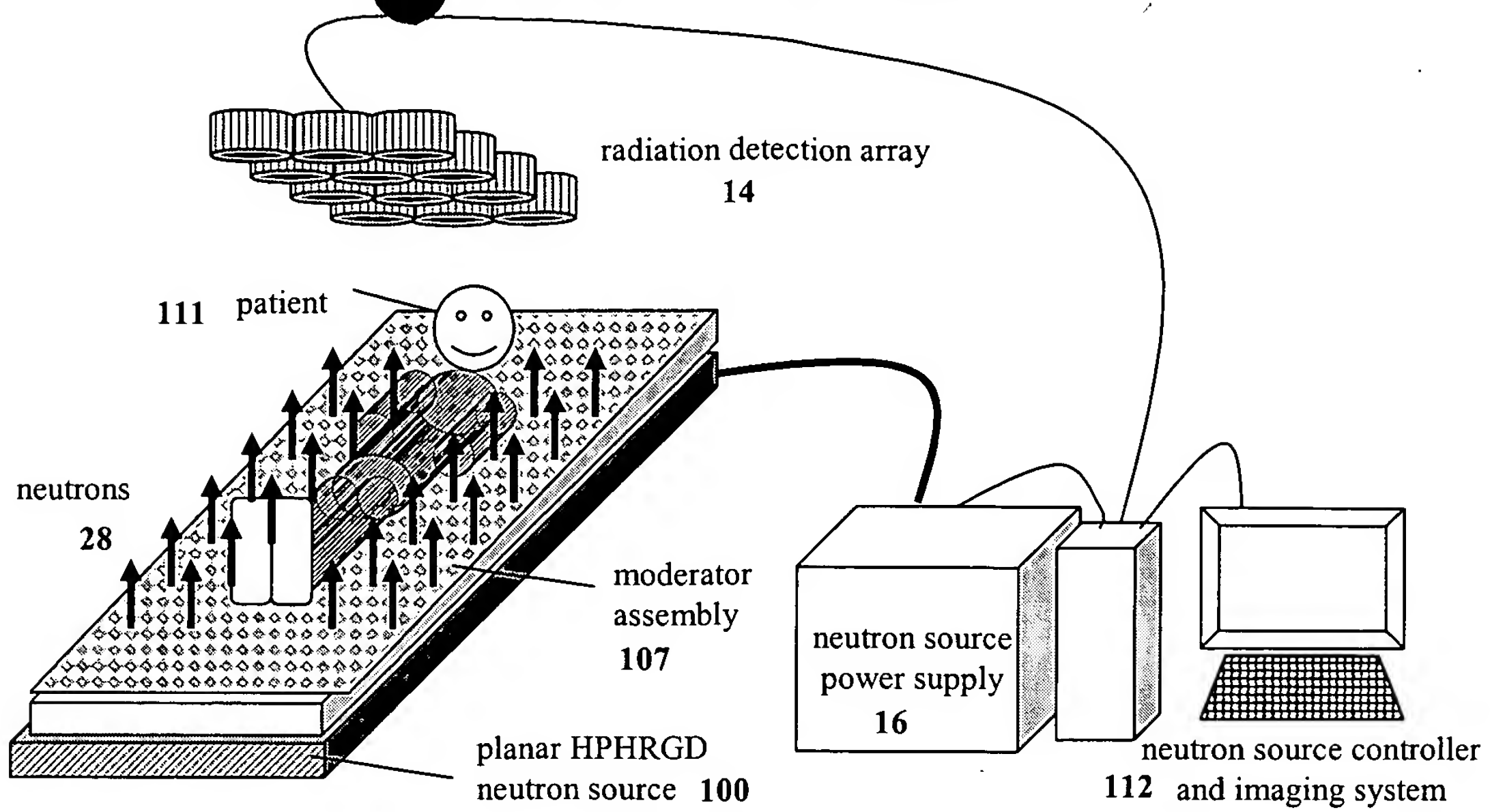


Figure 51.

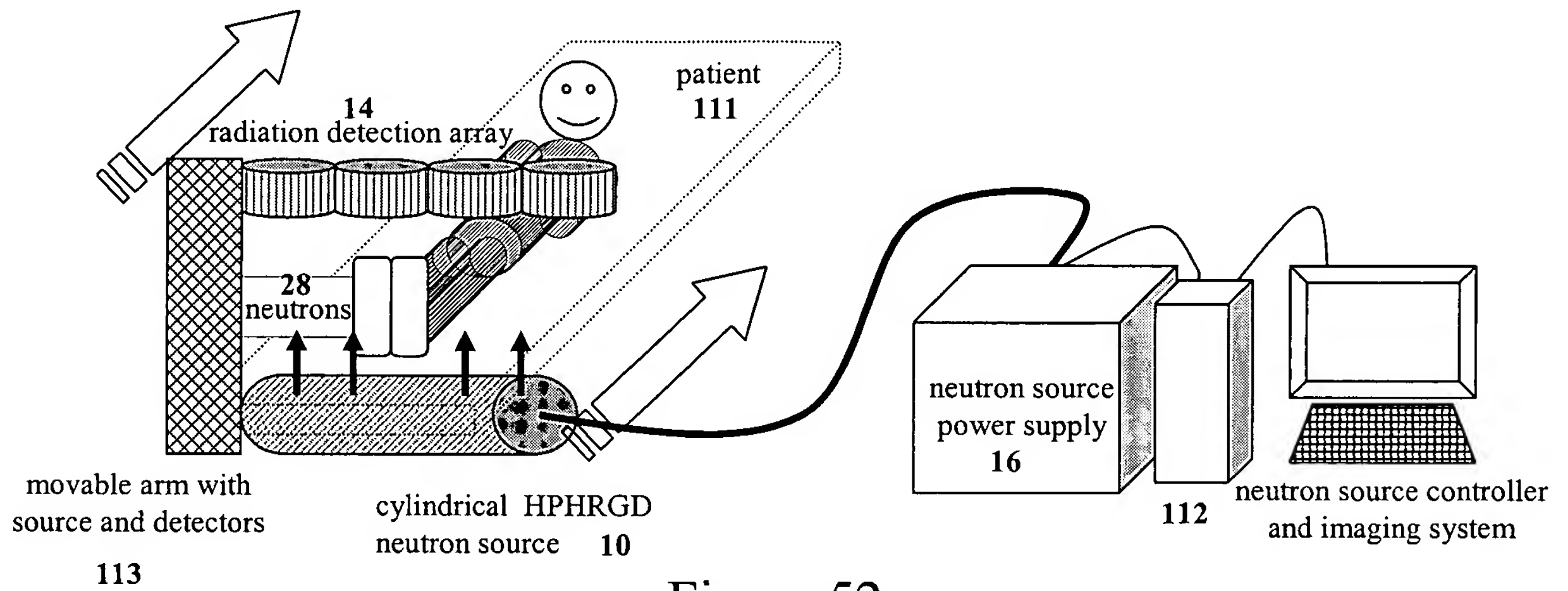


Figure 52.

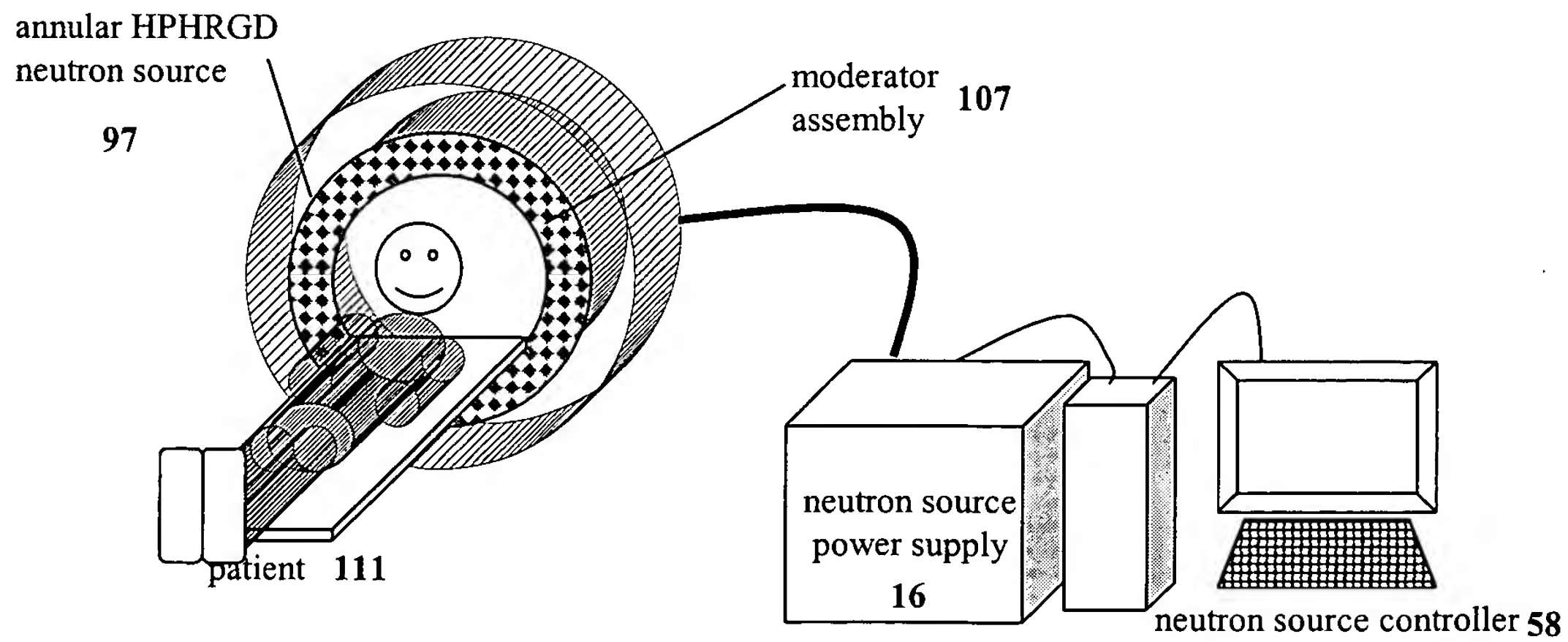


Figure 53.

10058561-012802

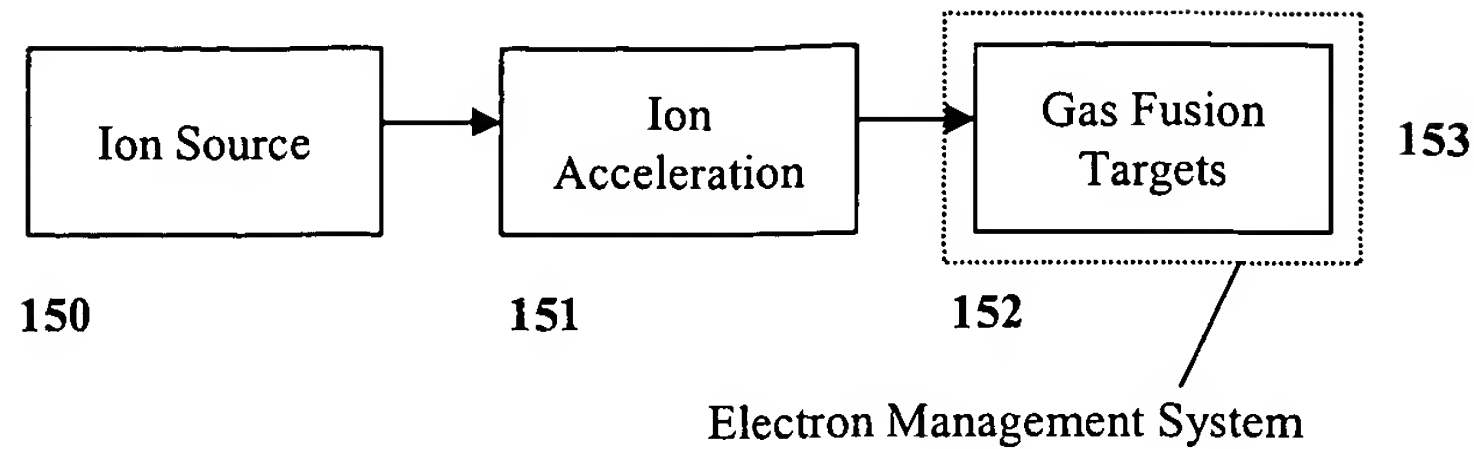


Fig. 54 (a).

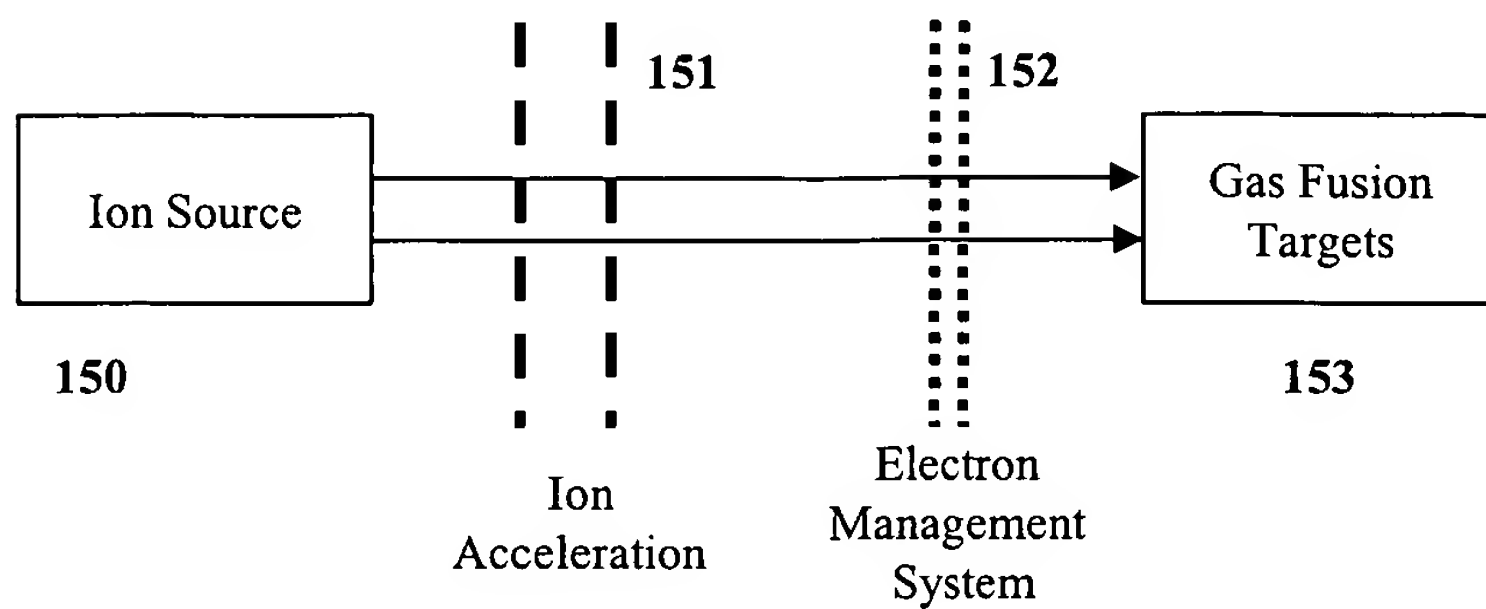


Fig. 54 (b).

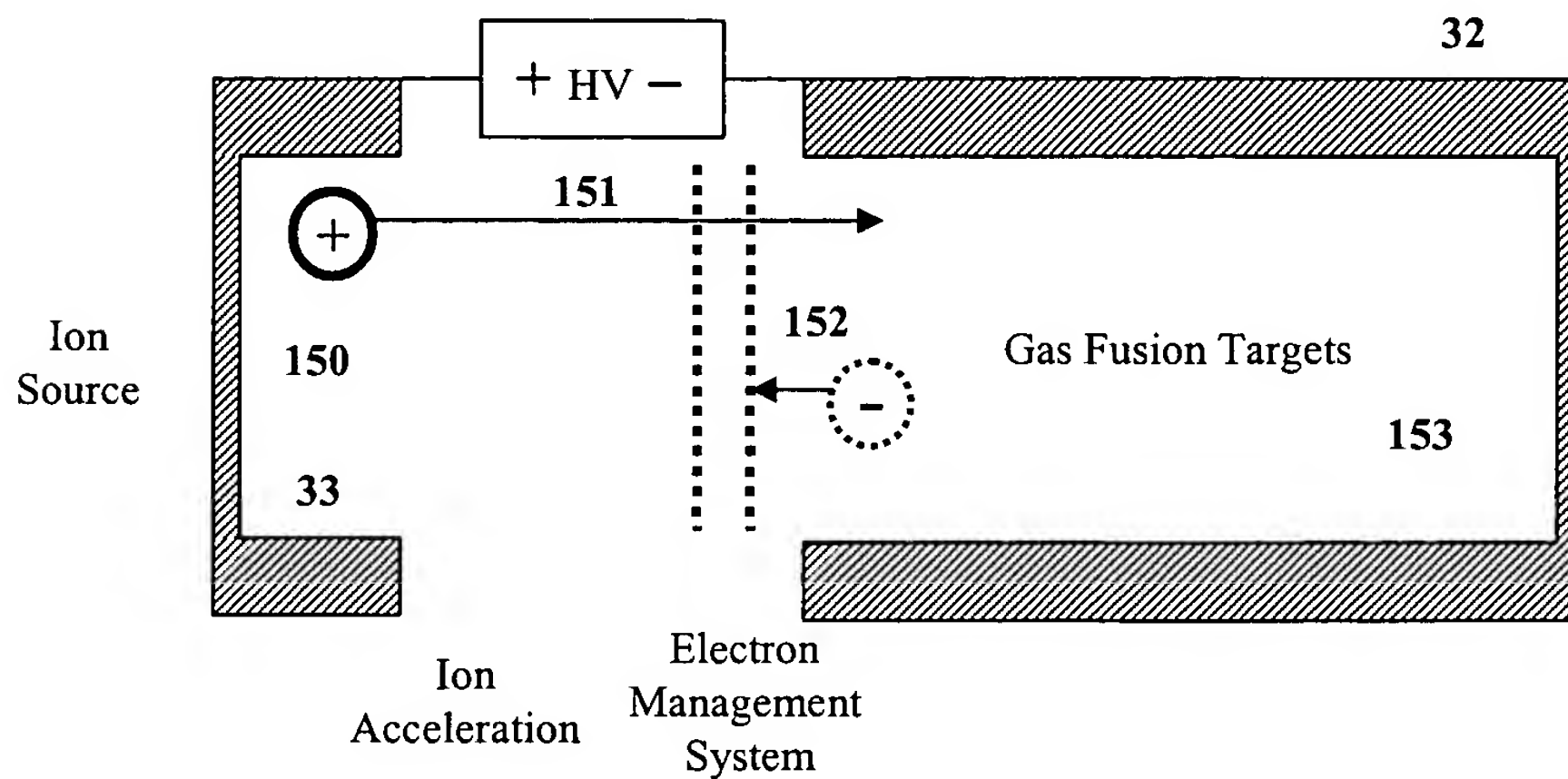


Fig. 55 (a).

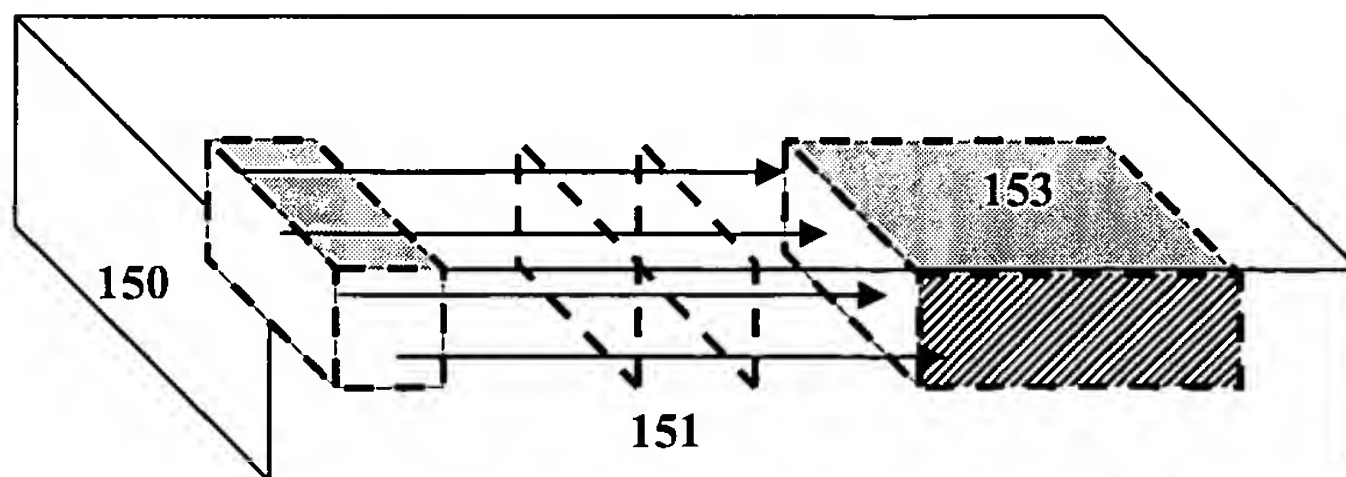


Fig. 55 (b).

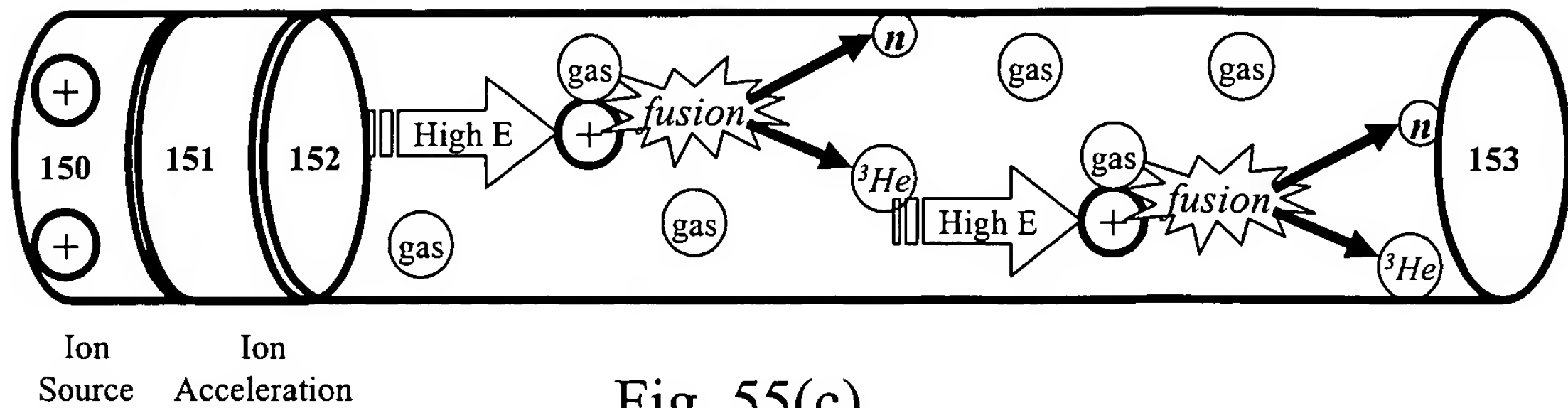


Fig. 55(c).

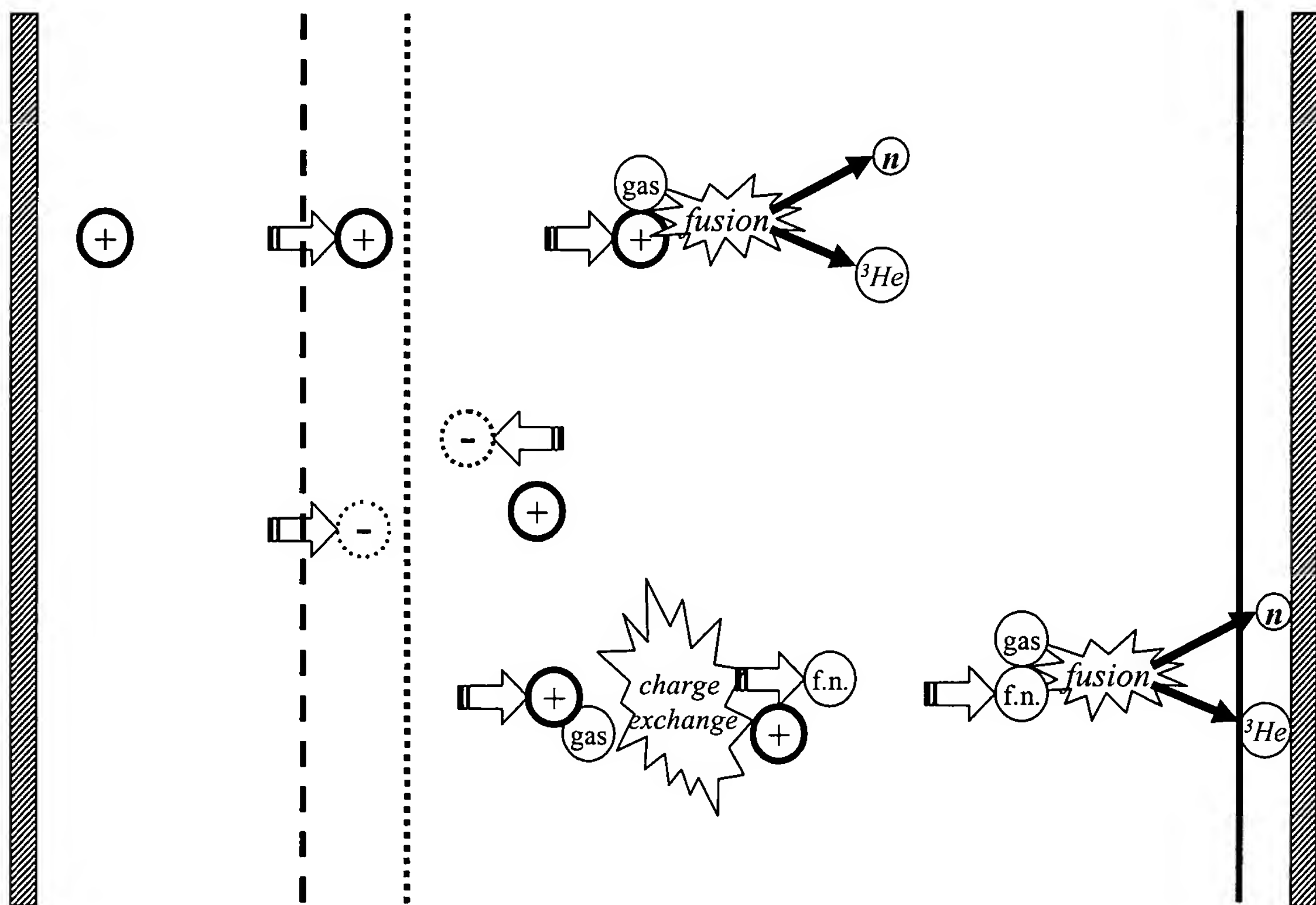


Fig. 56.

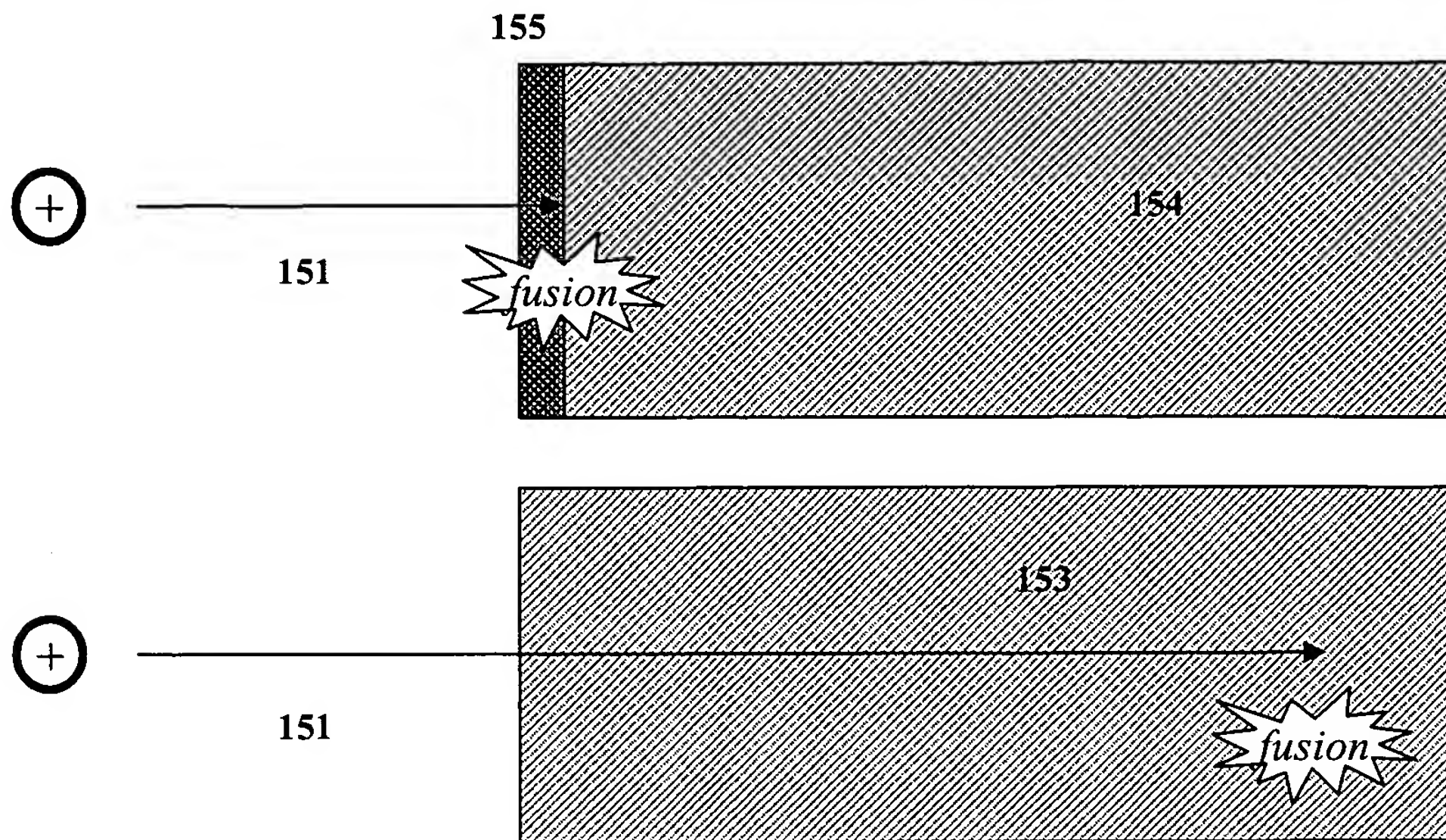


Fig. 57.

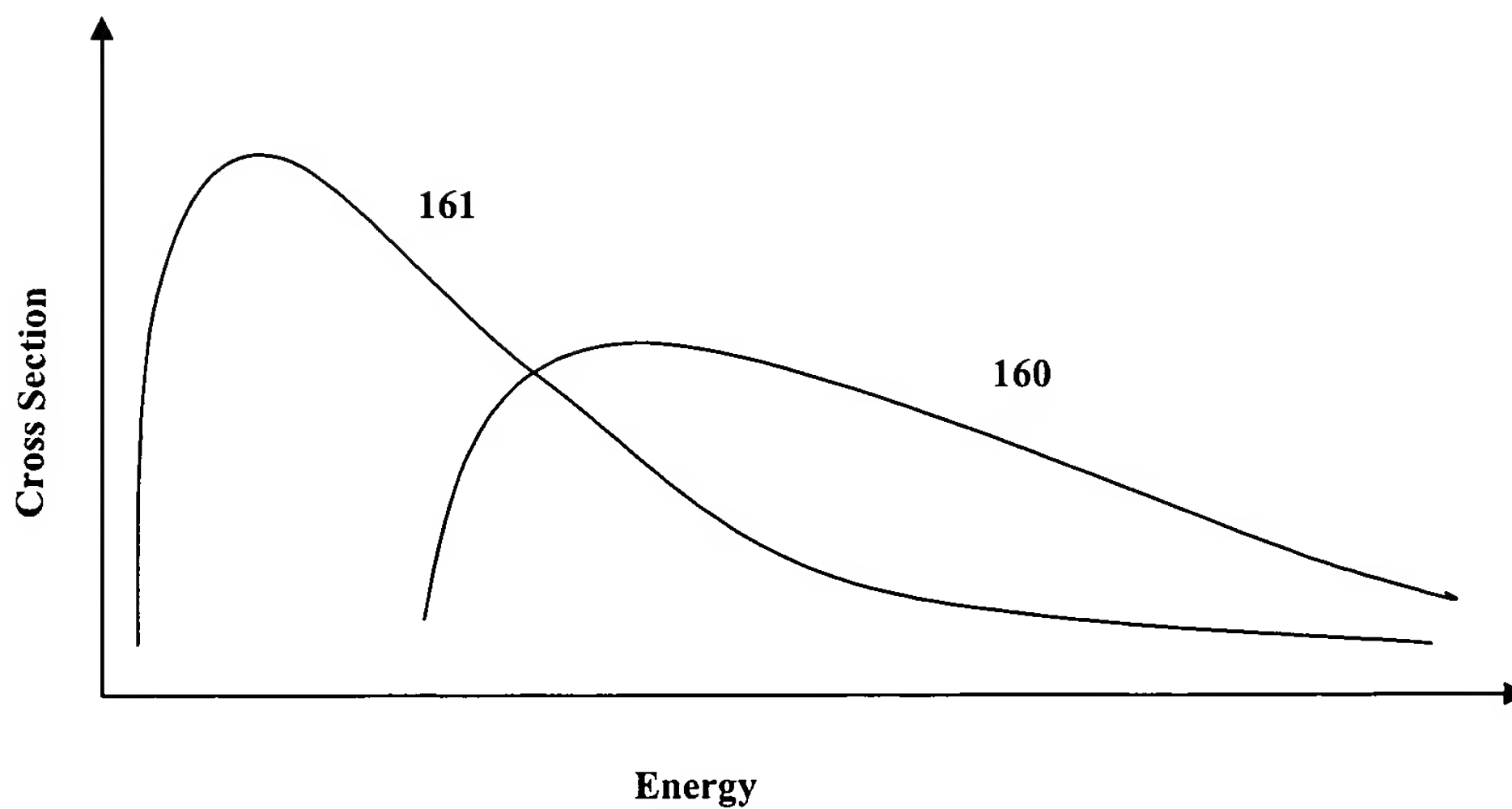


Fig. 58.

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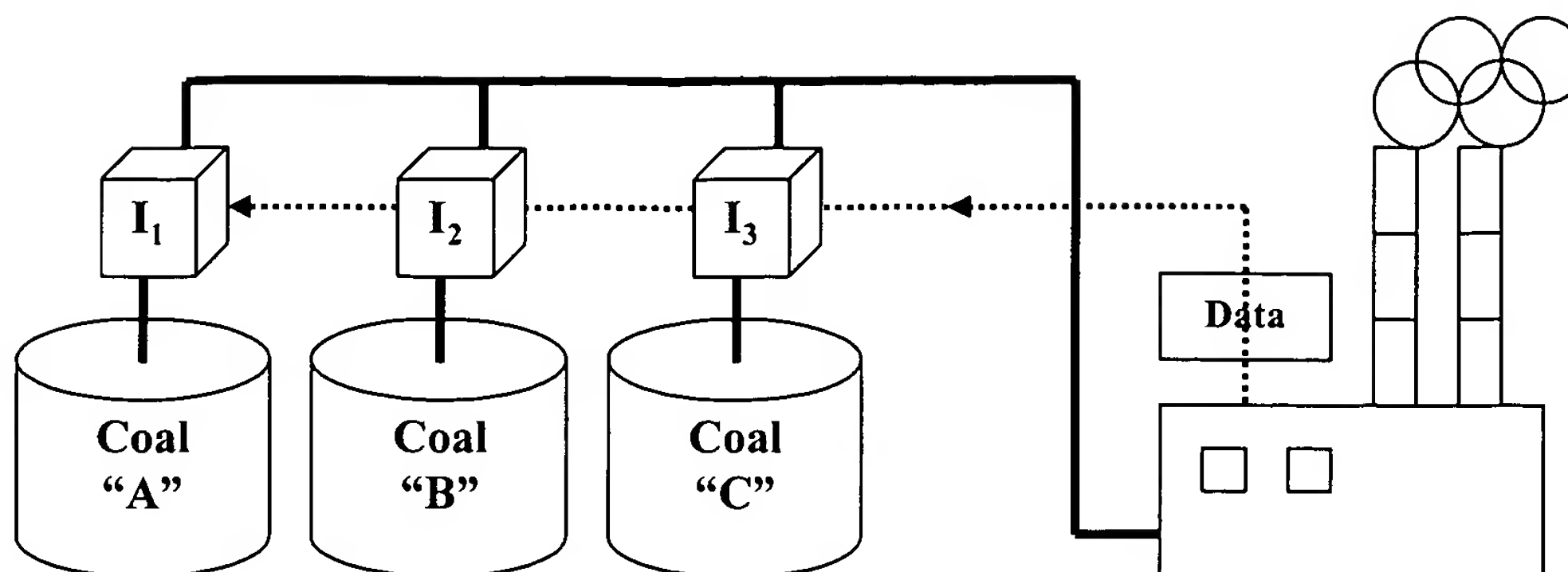


Fig. 59.

4005991.01.2022